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ING FEATURE ISSUE

A CHILTON

PUBLICATION

Iron Age

NATIONAL METALWORLD WEEKLY

NTS PAGE 2

December 10, 1953

DEC 11 1953

LAST EDITION

ANGANESE and
CHROME ORES
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E. J. LAVINO

and Company

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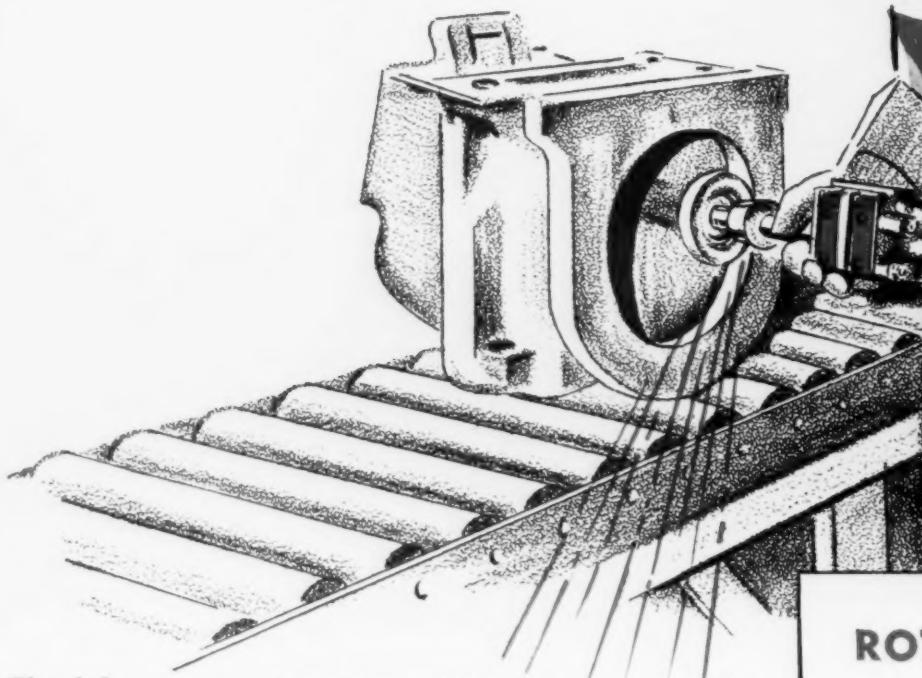
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65
SIXTY-FIFTH ANNIVERSARY

Cuts wheel cost

\$1500 per year



The job: Cleaning department of foundry was using 8" wheels with 4500 rpm grinders. When worn down to 5" or 6", wheels lost surface speed and metal removal dropped off. Wheels were laid aside or thrown away at this point.

Solution: Rotor Analyst suggested use of two Rotor 6000 rpm air grinders to use up discarded stub wheels.

Results: Investment of \$400 in new Rotor Grinders saves \$1500 yearly in wheel costs.

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ROTOR GRINDER FACTS

Rotor D125—6000 rpm—9 3/4 lbs.

Rotor D88—6000 rpm—9 lbs.

Others from 3100 to 20,000 rpm. Straight or spade handles. Ask for Catalog No. 38.

AIR

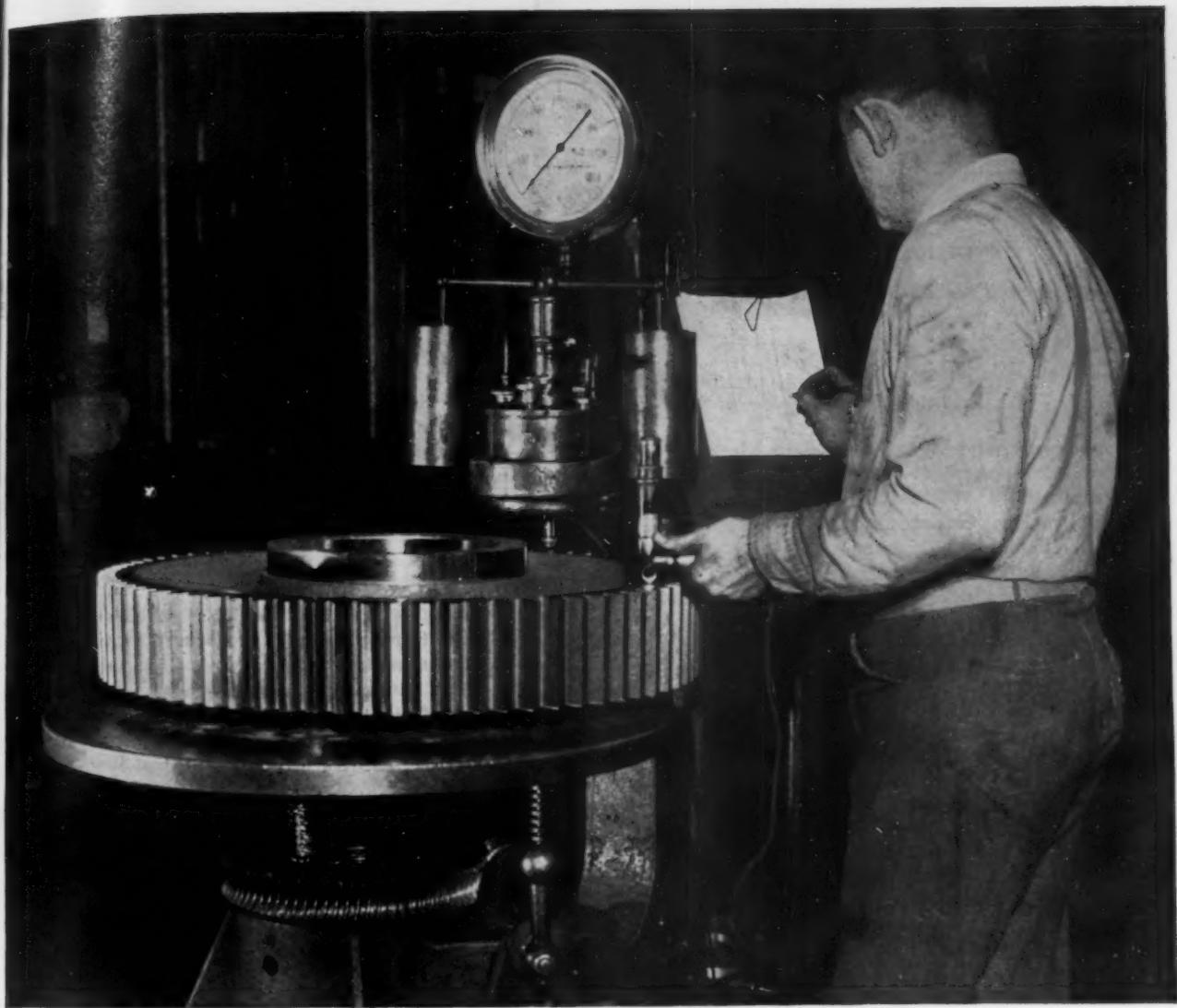
THE ROTOR TOOL CO.

CLEVELAND, OHIO

HIGH CYCLE

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

An illustration of a Rotor Tool grinder with an 'AIR' tag and a 'HIGH CYCLE' tag. The tool is shown in a side profile, and the tags are attached to the handle.



Checking a locomotive spur gear at one of the great General Electric plants.

Back of Every Good Gear Is a Good, Strong Blank

Big gears for diesel locomotive service have to run a gantlet of inspections and approvals by metallurgists, engineers, and machine-shop technicians. When products of this sort have been passed, no one can ever doubt their fitness.

The basis of a good gear is a good blank. Today, makers of top-quality locomotive gears are protecting their customers and reducing their scrap by using Bethlehem forged-and-rolled blanks for spur gears in traction motor drives. These same manufacturers report that the blanks are economical in first cost, sound metallurgically, and easy to machine.

Have you tried these forged-and-rolled blanks in your own operations? If not, there is no better time than right now. You'll find them ideal not only for gears, but for crane and

sheave wheels, flywheels, turbine rotors, industrial wheels, tire molds, and other parts where high strength without excessive weight is required. They are available in a wide range of sizes — 10 to 42 in. OD — and they can be furnished heat-treated or untreated, as you prefer.

Write for a free copy of Booklet 216. Lavishly illustrated, it will suggest many ways in which these sturdy, reliable blanks can ease design and production problems.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



BETHLEHEM FORGED-and-ROLLED CIRCULAR BLANKS

The Iron Age

Vol. 172, No. 24, December 10, 1953

★Starred items are digested at the right.

EDITORIAL

Cautious Budgeting	7
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NEWS OF INDUSTRY

★Special Report: Where Weldment Market Is...	75
★Raw Materials: RFC Stuck With Surplus Tin...	77
★Relations: What Makes Foremen Happy...	78
Construction: Garages Automate Parking	81
★Production: Electric Furnaces Dim Out	82
★Financial: Start Installment Stock Sales	83
★Manufacturing: Big Ingots for Plastic Dies	86
★Expansion: Some Writeoffs Still Available	87
Personnel: Iron Age Salutes	129
Iron Age Introduces	131
Clearing House	272

NEWS ANALYSIS

Newsfront	73
★Automotive Assembly Line	94
★This Week in Washington	99
West Coast Report	103
Machine Tool High Spots	105
★Report to Management	107

TECHNICAL ARTICLES

★Welding	137
A special 42-page section on latest developments in this field featuring savings in time, money and labor.	
Welding Briefs	182
Welding Notebook	233

ADVERTISING INDEX

★The Iron Age Summary—Steel Outlook	247
Market Briefs	249
★Nonferrous Markets	250
Iron and Steel Scrap Markets	254
Comparison of Prices	258
Steel Prices	260

REGULAR DEPARTMENTS

Dear Editor	9
Fatigue Cracks	11
Dates to Remember	13
Free Publications	109
New Equipment	114

INDEX OF ADVERTISERS

276

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Address mail to 100 E. 42 St., N. Y. 17, N. Y.

Digest of the Week

NEWS DEVELOPMENTS

WELDMENTS: WHO USES THEM, HOW MUCH?—P. 75
Machinery and equipment manufacturers will consume 3.37 million tons of built-up weldments in 1953, an Iron Age survey shows. Ship hulls, auto chassis, frames and bodies, tanks, welded pipe and others will swell the already impressive total. Nearly half of the firms buy some of their weldments.

WHAT IT TAKES TO MAKE FOREMEN HAPPY—P. 77
Taft-Hartley helped put company foremen more solidly on the management team—but are they happy there? This question was probed at a standing-room-only meeting of American Management Assn. in Chicago last week. Poll shows two out of three foremen are on very good terms with management. List ill.

PLASTIC MOLDER WANTS "DESK-SIZE INGOT"—P. 86
"Your ingots aren't big enough," a molded plastic manufacturer recently told an alloy steel producer. This stresses the size growth of dies needed by the plastic industry. Not long ago a 3000-lb die was unusual—today 18,000-lb die sets form TV cabinets. Compression injection molds are both growing.

TRANSMISSIONS BOOST AUTO TOOLING COSTS—P. 90
Next to the threat of fading sales, biggest concern of automakers is astronomical tooling cost. Any major development is coupled with untold millions in tooling costs. Body and engine changes used to bring bigger bills—but tab for automatic transmission tooling equals setting up for a new engine.

WAY CLEAR FOR SOME DEPRECIATION RELIEF—P. 94
Now that both the Administration and Congress agree that a balanced budget for fiscal '55 is "impossible," there is greater reason to believe that easier depreciation allowance on tools, machinery, plant equipment may be written into the new tax law next year. Foreign aid is ripe for the axe.

UNION LEADERS RENEW GUARANTEED WAGE—P. 107
Current firm statements by steel and auto unions are bound to be interpreted as promises by the rank and file to get a guaranteed annual wage. With this may come the obligation to win some annual wage concession. Unions may take any sort of deal, rely on the future to fortify and expand it.

Week in Metalworking

MARKETS & PRICES

STOCKPILE SURPLUS LOOMS OVER TIN MARKET — P. 77
RFC is wondering how to dispose of some 40,000 tons of tin not needed for the stockpile without causing a complete market collapse. Tonnage represents an 8-month U. S. supply and dwarfs the proposed 25,000-ton offer pool. Meanwhile, a bullish market was reversed in news that RFC may sell the surplus.

ELECTRIC FURNACE DIP MAY END IN EARLY '54 — P. 82
Final phase of inventory correction, due in first quarter of 1954, should bolster depressed electric furnace rates. End of conversion, slump in alloy demand, military cutbacks cut electric output. With electric capacity at 10.2 million tons, rates won't bounce back to record levels of past 4 years.

START INSTALLMENT PLAN STOCK BUYING — P. 83
Securities will be sold through periodic cash payments starting Jan. 25 under a new New York Stock Exchange plan. Customers of N.Y.S.E. member firms may purchase stocks listed on the Big Board through payments that start at \$40 every 3 months. No margin, contract, extra charges or higher commissions are involved.

YOU CAN STILL GET SOME TAX WRITEOFFS — P. 87
Government is still issuing certificates of necessity for 8 items needed for defense. These are listed for you. Expansion goals for 120 items have been reached. Issuance of certificates on 49 other items has been stopped pending a decision on whether more expansion is needed. DOD divided programs into three lists.

BUYERS' STRIKE CUTS STEEL ORDER BACKLOGS — P. 247
Steel buyers are making their weight felt in the market. They are still paring inventories, ordering barely ahead of production needs. And they are exerting strongest pressure on prices. Purchasing is competitive, too. Buyers are zealously striving to make sure their concessions are equal to competitors'.

CHILE SENATE APPROVES COPPER PROPOSALS — P. 250
A long stride toward clearing up the confusion in copper was taken last week when the Chilean Senate voted approval of committee recommendations. But the lower house hasn't voted yet and tax legislation must be passed. Price for surplus is 30¢, while future production will go at market level.

Feature Issue

WHAT'S NEW IN WELDING

JIGS, FIXTURES RAISE WELDING OUTPUT — P. 138

The key to mass production of high quality weldments is the well designed jig or fixture.

BEST WAYS TO WELD STAINLESS STEELS — P. 142

Relatively low current, small diameter rod and stringer bead technique produce best welds.

INERT GASES AID MAGNESIUM WELDING — P. 145

Helium and argon offer excellent protection to weld zone. Some aluminum content helps weldability.

FORCE FITS AID TO ALUMINUM BRAZING — P. 148

New technique for joining aluminum tubes combines force fitting and brazing, stops flux penetration.

TIPS FOR BETTER INCONEL WELDMENTS — P. 150

Thorough cleaning prevents embrittlement. Use shallow penetration and low heat input.

CORROSION-FREE BRAZING OF TYPE 430 — P. 159

New alloys stop corrosion in silver brazing joints of Type 430 and other chrome-grades of stainless.

SOLVING TOUGH HARD-FACING PROBLEMS — P. 164

Two methods beat problem of hard-facing an extrusion screw. Special setup hard-faces steam valve wall.

WELDING SERVES AS MAINTENANCE TOOL — P. 168

Maintenance welding in Ford's River Rouge plant is simplified by breaking jobs down to small size.

WHERE AND HOW OF RESISTANCE WELDING — P. 172

Bulk of work is done on small and moderate-sized parts. Precontrol is a necessity.

SOME KEY POINTS IN WELDING SAFETY — P. 177

Common sense, knowledge of equipment and its uses, proper attitudes are key points for safety.

WELDING BRIEFS: NEW PLANTS, PRODUCTS — P. 182

Short subjects of timely interest on plant layout for welding, new electrode for cast iron and others.

WELDING NOTEBOOK: TOUGH JOBS SOLVED — P. 233

Problems and solutions on unusual welding applications using various metals, setups, techniques, materials.

Condor Compensated Belt—More use per dollar

MORE PULL IN EACH PLY . . . When Condor Compensated Belt rounds the pulley every ply is under uniform tension (illustration, right). There are no "loafing" inner plies or over-worked outer plies to rupture and start belt failure (illustration, left). This exclusive R/M method of equalizing ply stresses was developed by R/M engineers to eliminate fastener troubles and ply separation. A selection of driving surfaces for various tension requirements is available. This all adds up to **MORE USE PER DOLLAR**. Ask the R/M distributor for Bulletin 6808. He can also help you get **MORE USE PER DOLLAR** with R/M hose, conveyor and V-belts.



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RAYBESTOS - MANHATTAN, INC.



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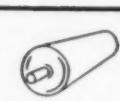
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Editorial

The Iron Age

FOUNDED 1855

Cautious Budgeting?

THESE are a lot of quiet pessimism taking place behind closed doors these days. It almost looks as though it's time to get out the crying towels. Some of this might be in order but it isn't really necessary. It is just a reaction from years of peak operations.

If this private tear-letting were to be just that and nothing more all would be well. But from this anxiety may come some action that would be bad for business and could start a chain reaction. Even Mr. Humphrey, our genial Secretary of the Treasury, found that deflation was harder to control than inflation. He learned his lesson quickly.

Now is the time when budgets and inventories get the once over as plans are made for 1954. Most firms are sure that next year will be a "good" year. But it won't be if the majority of our industrial leaders decide that this is the time to cut expenses and inventories and get into the storm cellar. Fortunately most of them do not feel that way—but some do.

Here are a few check notes to ponder as you work on or approve your plans for next year:

If your business is good—if you have a good product and your potential is on the upgrade—this is no time to cut expenses, decrease promotion and advertising, sit back and wait. This is the time to give it all you have—if you want to keep ahead of competition.

There is little chance that raw material prices will go down next year. Labor rates and other costs are built in to stay that way for quite a spell. That means that unnecessary cutting of stocks or inventory is poor business. Basic materials and standard items are just as good as money in the bank; especially since there is a 50-50 chance of labor trouble in 1954.

If we are to fully support the defense program we have to have as much full employment as possible. The decisions executives make these days are far more serious and loaded with responsibility than ever before in our history. The economy must be kept at a high level if we are to have adequate guns and butter. A depression is not in order today no matter how much "good" some people think it might do.

The public is not disconcerted nor is it panicky over business conditions. Let's make sure that it does not get that way from watching how business acts. Some sleep may have to be lost to make sure that budget and inventory actions taken by key companies are prudent and fit the facts. If the decisions are faulty the people's judgment will be severe—and costly to private enterprise.

Tom Campbell

Editor

USE

MonoRAIL CRANES

- { ... Where Space is Limited
- ... To Handle Variable Jobs
- ... For Low Maintenance Cost

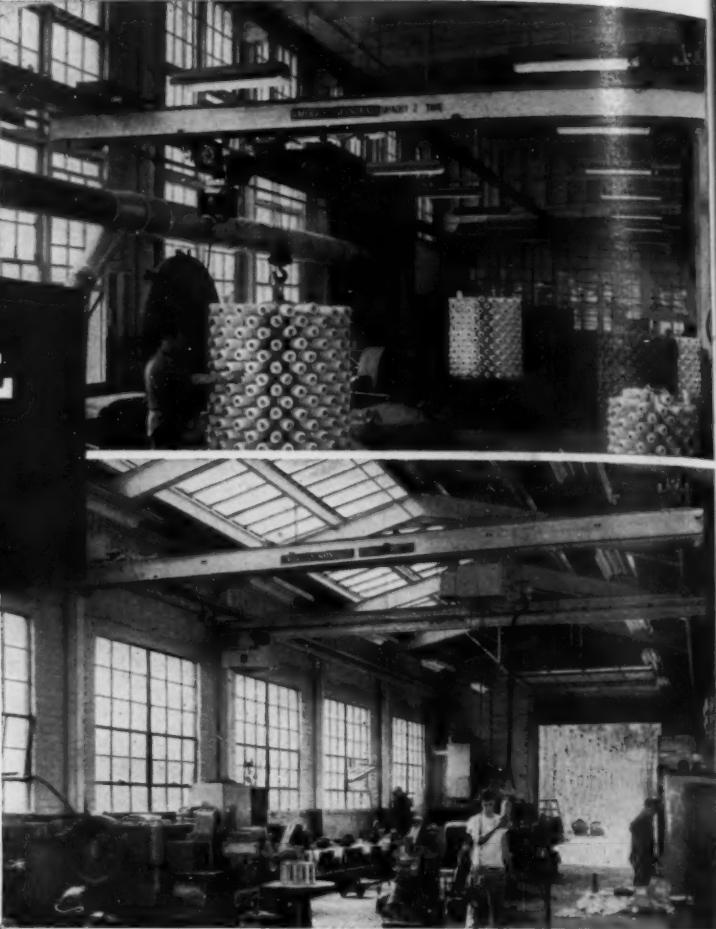


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of C-1 Bulletin



AMERICAN

OVERHEAD
HANDLING
EQUIPMENT



These are just a few reasons why American MonoRail Cranes are gaining in popularity and are being installed in increasing numbers of plants the country over. Call in your American MonoRail representative and have him tell you all the advantages of MonoRail Cranes such as—ease of handling—smooth travel—strength—safety interlocks—power operation and interlocking carrier service between and beyond the craneways. Consultation in connection with any handling problem is available without obligation.

13103 ATHENS AVENUE • CLEVELAND 7, OHIO

Dear Editor:

Letters from readers

Hot Metal v. Cold

Sir:

Your article on p. 96 of the Nov. 19 issue has been a topic of discussion among the scrap iron people here in Western New York State. In substance, your article declares that there will be a large decline in the steel mills' need for scrap because the mills are changing over to hot metal from cold.

There are dealers here who pooh-pooh your article; they say it's a story "planted by the steel mills to scare the scrap dealers." But this I don't believe. For I believe firmly in the integrity of IRON AGE. I know you won't be a party to a "planted" story. I believe that you have no ax to grind and that you report the news as it happens, without angles.

May I ask you what is meant by "hot metal" and how it comes about that "hot metal" cuts down the need for scrap, and why No. 2 grades can be substituted for the No. 1 grades?

C. LEMMEL

Ormond Waste Material Co.
Rochester, N. Y.

Our reference to "hot metal" means pig iron that is moved from blast furnace to openhearth furnace without being permitted to cool. It is anticipated that ability to use hot metal in the openhearth charge instead of a completely cold charge will result in less use of scrap. Presumably this will be to the economic advantage of the mill because heats can be melted faster with less fuel consumption and greater steel output. Use of hot metal in the openhearth charge permits faster melting, thus allowing substitution of No. 2 grades of scrap in place of No. 1.—Ed.

Beg Yo' Pardon!

Sir:

We found your "Salute to the South" in the Nov. 12 issue of THE IRON AGE on the whole well done, but on p. 226 there appears an error which I am sure you will want to correct—That is the listing of the North Carolina Dept. of Labor as the agency from which to obtain industrial information about the State. The proper source for this information is the Dept. of Conservation and Development in Raleigh, N. C.

CHARLES PARKER
Director

State Advertising Division
Dept. of Conservation & Development
Raleigh, N. C.

Hot Rods

Sir:

In the Newsfront of Oct. 22, you make reference to automakers easing into the hot rod sports car field.

We would appreciate a list of companies that you believe to be entering this field, and, in particular, the one mentioned as offering a kit of dual carburetion, etc.

J. J. ROCHLIS

Blair, Rollins & Co.
Philadelphia

For a list of companies entering the hot rod sports car field, we suggest you contact the Chrysler Corp., 341 Massachusetts Ave., Detroit, Mich. This company is the manufacturer of the heavy-duty kit of dual carburetion.—Ed.

Portable Electronic Device

Sir:

The IRON AGE Newsfront, p. 109, of the Nov. 12 issue mentions a portable electronic device which inspects steel rail soundness by supersonic means.

We would like to receive more specific information concerning this electronic device. Would you please send us the name and address of the company now supplying this equipment?

R. E. LATTINVILLE
Advertising Dept.
Bay State Abrasive Products Co.
Westboro, Mass.

The manufacturer of this electronic device is Bronson Instruments, Inc., Stamford, Conn.—Ed.

Sheet Sorter

Sir:

On p. 275 of the Oct. 8 issue of THE IRON AGE, there is a description of a sheet sorter. We would appreciate your giving us the name and address of the company which is planning to build this machine.

L. B. VANDERHORST
Sales Manager
Merz Engineering, Inc.
Indianapolis, Ind.

The company planning to build the sheet sorter is the Pratt & Whitney Division, Niles-Bement-Pond Co., West Hartford 1, Conn.—Ed.

Radiant Burners

Sir:

We have read with great interest the article, "Radiant Burners Improve Galvanizing Quality, Cut Costs" from the Nov. 5 issue of THE IRON AGE.

Would you please send us 10 tear sheets so that we may distribute them to key operating men at our various works?

W. W. FULLER
Works Industrial Engr.
Cyclone Fence
Waukegan, Ill.



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*pronounced Die-ack-ro.

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Creators of "Die-Less Duplicating".



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302 Eighth Avenue
LAKE CITY, MINNESOTA





"He who makes no mistakes does nothing"

In a supposedly modern era it is sometimes claimed to be "smart business" to let a competitor take the lead and make profit from his mistakes. Obviously, if all business adhered to such a philosophy there would be no progress, if any business. "He who makes no mistakes does nothing". Cone leadership was founded — and is maintained — by active service, by doing things.

The Conomatic Carbide Development program expects to make a few mistakes. But, loss or gain, its efforts will contribute to the general benefit of all "automatic" users, users on whom all "automatic" builders are dependent.

The job illustrated compares actual production runs with HSS and 100% carbide tooling. It suggests the kind of pioneering that is being done at Cone. Full details are available.



MATERIAL—1112 STEEL: Hole drilled with 1" dia. drill to 2 $\frac{3}{4}$ " depth. OD threaded to 2" length with 1 $\frac{1}{4}$ "—12 chasers.

	HSS	CARBIDE
Cycle Time	90 secs.	15 Secs.
Work Spindle Speed	370 R.P.M. at 103 S.F.	1500 R.P.M. at 417 S.F.
Tool Wear	1500 pcs. per grind	5000 pcs. per grind



Conomatic}

CONE AUTOMATIC
MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

Fatigue Cracks

by William M. Coffey

Notice

There's nothing in this column this week of importance to anybody. It isn't illuminating, funny or clever. Just the same old brilliant and penetrating analysis of the industrial scene by America's dean of journalists. So suggest you skip it this time.

On the Job

As we take *la plume sur le mane* (the pen on the hand—fr.) the 10 million odd people of New York City are still groping blindly for the news of the day. All major newspapers have suspended publication due to a strike of the photo-engravers' union. Jumping into the breach, of course, is your *ffj* and although we've never tackled murders, politics or the UN we feel it our duty as long as there's a breath left in our presses to briefly digest what has occurred in the way of general news.

New York's Planetarium announced a new policy as did the White House, the New York Crab Exchange and Yale University . . . India agreed to loan the American Manufacturer's Assn. \$20 million and we don't have to pay it back . . . Sir Winston Churchill left for an 18-day luxury cruise to Bermuda, all expenses paid, first prize for winning the Clean Soap Contest . . . Marilyn Monroe was elected Chairman of the UN's Committee on Human Rights; Mrs. Roosevelt relieved . . . Russia agreed to foot the bill, everybody was slapping each other on the back . . . Sen. Joe McCarthy said we'd stick it out for another year . . . Mr. Truman said he was willing to bury the hatchet . . . and Little Orphan Annie was finally done for at the age of 76.

... CONTINUED

The newspaper strike left another mark . . .

The lurid covers on paper-bound novels that flood the newsstands are pretty hard to pass by (for a lot of people) without a sneak—albeit disguised—look now and then. We've suspicioned that the thousands upon thousands of New York commuters for many years have yearned to do a little more than just glance at these things but because newspapers were available and respectable they never really got their nerve up. NOW what's

happened? No newspapers, so all suppressed desires burst like at Yucca Flat. The newsstands are doing a whale of a business with the two-bit novel. And nobody even bothers to tear the covers off!

Take the distinguished old gentleman who regularly alights next to us on the 7:34 each morning. Always used to read the Wall Street paper. Could swear he's a senior trustee of Harvard or President of Chase. Without batting an eye he now whips out NIGHT NURSE in the most flagrant manner and settles down for an hour's concentrated study. Walk the whole length of the aisle. Everybody is doing it. MASIE'S MANSION . . . SCARLET FLAME . . . WEEK-END LEAVE . . . CASE OF THE MISSING EAR, etc. Even reading MANBAIT ourselves. Real good.

Just Thrown In

Most of the Marshall Field partners started as office boys or clerks. That large organization built its executives from the bottom. When the great showman-merchant, H. G. Selfridge, resigned as Field's general manager, old Mr. Field merely grunted, "Well, we'll have to get another office boy."

* * *

The "most treasured name in perfume," CHANEL, is now advertising No. 5, Gardenia, No. 22, Bois Des Iles and *Russia Leather*. How did that last get in there? Something real smelly about Russian leather?

Puzzlers

The highest number of different combinations of 21 coins that total a \$1.00 is five (Nov. 19 Puzzler). Winners: Carl A. Johnson, Gustaf Alsterlund, and Albert Alles. Many others said four or three. But no soap.

New Puzzler

A weight of 1000 pounds hanging 2 feet from one end of a lever is to be raised by an upward force at the other end. The lever weighs 10 pounds per foot. Find length of lever so that the force will be as small as possible.

This comes from Bill Braasch. It was sent to us by his daughter who says "I am writing this for my Daddy, I like to write and I like to look through IRON AGE." You write very well. THE IRON AGE hereby gives you an "A" in writing.

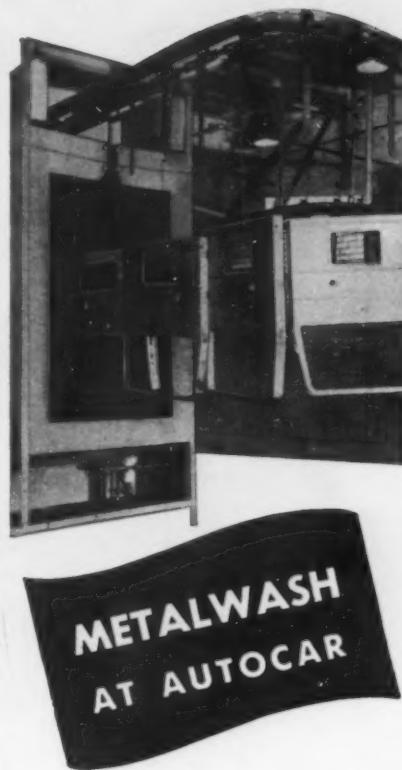


Illustration shows cab doors for Autocar trucks being cleaned, phosphate coated, and dried.

This METALWASH phosphate coating machine provides an ideal surface for a lasting paint finish on truck chassis and sheet metal parts.

Cleaning and phosphating are uniform since the cycle is automatically controlled. Continuous operation, built around the conveyor line, eliminates material handling problems.

Metalwash Finishing Engineer, published quarterly, is available on request to engineers and executives to whom cleaning and finishing are operations of interest.

Write on your company letterhead for your free copy.



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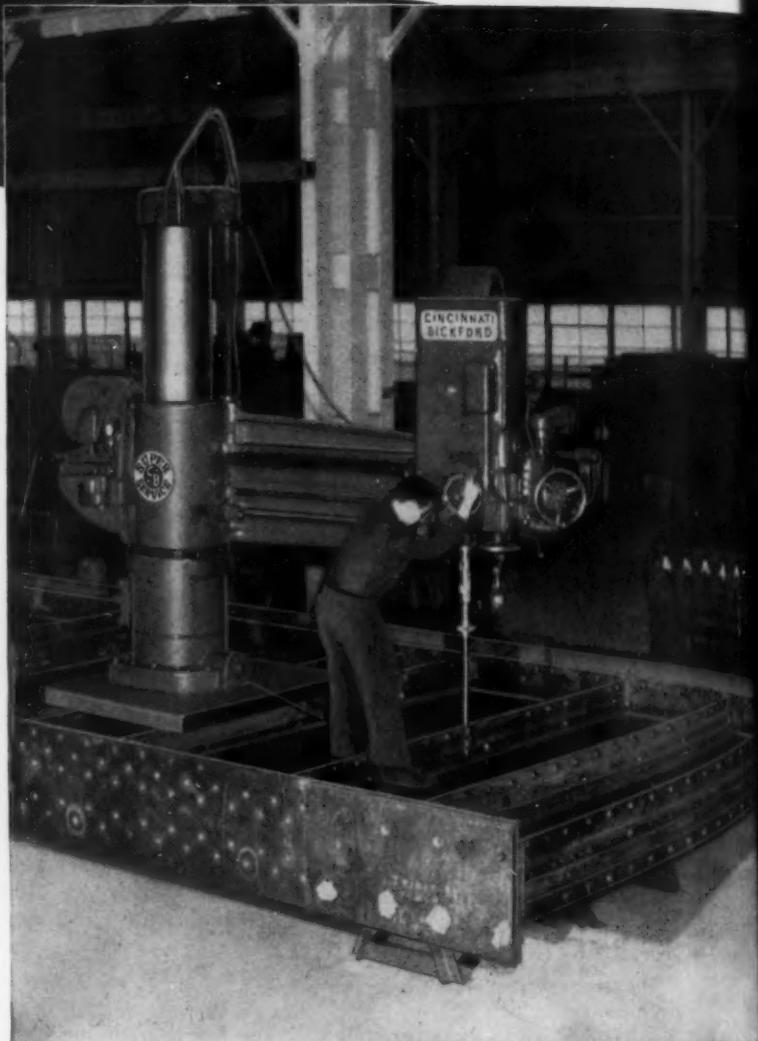
CINCINNATI BICKFORD

saves 50% to 75%

AT
LINK-BELT
COMPANY

Instead of positioning this 57,100 pound girder for drilling operations, the machine is moved by crane to the job.

This 6-foot arm, 17-inch diameter column Cincinnati Bickford Super Service Radial Drill is equipped with a lifting bail for portable use on large structural members and base plates where it is much faster to move the machine than the work. The machine is never clamped to the piece or floor for these portable drilling operations since it is properly balanced and of ample weight to neither tip nor rise up while drilling. Various sizes of holes are drilled in the part shown. Savings of 50 to 75 per cent over the previous method which used two men and a portable air drill, have been effected.



Photos made at the new Link-Belt Company plant in Colmar, Pa.

CINCINNATI
BICKFORD



RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

THE IRON AGE Newsfront

POWDERED METAL WELDING ELECTRODES are receiving favorable comment from commercial users. Deposition rates and welding speeds with these contact type electrodes are reported double those for standard electrodes. Weld quality is claimed comparable to that of welds made using other standard methods.

DESPITE SLOWNESS OF FOUNDRY DEMAND a substantial drop in merchant pig iron prices is not expected in near future. Combination of demand from producers of high quality castings and raw materials and labor costs should block a severe drop.

HIGH TOOLING COSTS have made many automakers rely on outside suppliers or their competition for automatic transmissions. Cost of tooling up for a complicated automatic transmission actually compares with the cost of tooling for an entire new engine.

AN EXPERIMENTAL GAS TURBINE has been operating satisfactorily at 1800° to 1900°F--or about 400° above the current level for gas or jet turbines. Object is to prove titanium base carbides for this service, explore possibilities for high powered, longer life commercial gas turbines.

TIGHT NICKEL SUPPLY has steel producers worried. Some alloy mills say their inventory is approaching danger point. Gray market nickel anodes are being offered at \$1.50 per lb.

BIGGER PIPES FOR OIL TRANSMISSION lines is the trend in new construction programs. Emphasis is on pipe larger than the customary 8-in. diam used for trunk lines for refined products. Also, six of each 10 miles of pipe taken up are going back into the ground.

POWERING THE LIGHT PLANE which recently climbed 37,063 feet for a new altitude record was a gas turbine. It weighed about 125 lb less than the piston engine normally used in this plane. Power ratings: 210 hp on takeoff; 175 hp at cruising speed.

LOWER DOWN PAYMENTS AND LONGER PAY-OFF terms for government backed mortgages, may be a revised federal housing policy early next year. Idea is to help check expected 1954 dip in residential construction, keep new starts above 1 million, prop demand for building materials, household goods, appliances.

AUTO EXECUTIVES CAN'T REST on their laurels in the intense competitive market of today. Average age of the 26 top executives in one large company has dropped from 59 to 46 in a single year.

A HIGH-EFFICIENCY AIR FILTER has been developed for use at 500°F or higher. Noncombustible materials resist corrosive gases and fumes, stand frequent wetting or drying. Felt-like material of all-mineral fibers is bonded with synthetic resin. Very fine glass fibers provide bulk of the fiber composition.

TITANIUM LOCKNUTS developed originally for aircraft applications, will soon be available commercially. They meet tensile requirements for steel locknuts. Design changes and use of titanium helped cut weight in half.



STRAIGHT FROM A Specialist

Generally a specialist is the best qualified operator in a restricted area of activity—a master at his trade. Our field is the production of cold rolled strip steel. That is all we do. All our efforts are directed toward the problem of producing a steadily improving quality and grade of cold rolled strip steel to meet specific production requirements and end product goals.

This specialization has led to the development of many "special specs"—specifications designed to solve individual problems as contrasted with all-purpose specifications which are general in nature.

Within the steel industry, we operate in a very limited field. But in that field, which includes such specialized features as special grades, sizes, tolerances, finishes, structures and physical properties, we have a wealth of experience on which we can draw to help solve any problems in the fabrication and utilization of cold rolled strip steel.

It is quite possible we have something to offer you in the way of an improved product or in the means of achieving a lower production cost. We believe you will find it profitable to review your fabricating operations in terms of what CMP STRIP STEEL can do for you.



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WELDMENTS: Who Uses Them, How Much?

Iron Age survey shows machinery, equipment manufacturers will consume 3.37 million tons of built-up weldments in '53 . . . Nearly 50 pct of users buy some of their weldments.

There has been a steady increase in manufacturers' use of weldments since the 1920's, but very little specific information has been available on how important weldments have become to the metalworking industry.

To find out many of these unknown facts, THE IRON AGE Research Dept. surveyed a large portion of the equipment and machinery manufacturing industry. Results showed that firms in this category will use an estimated

3.37 million tons of weldments in their products this year.

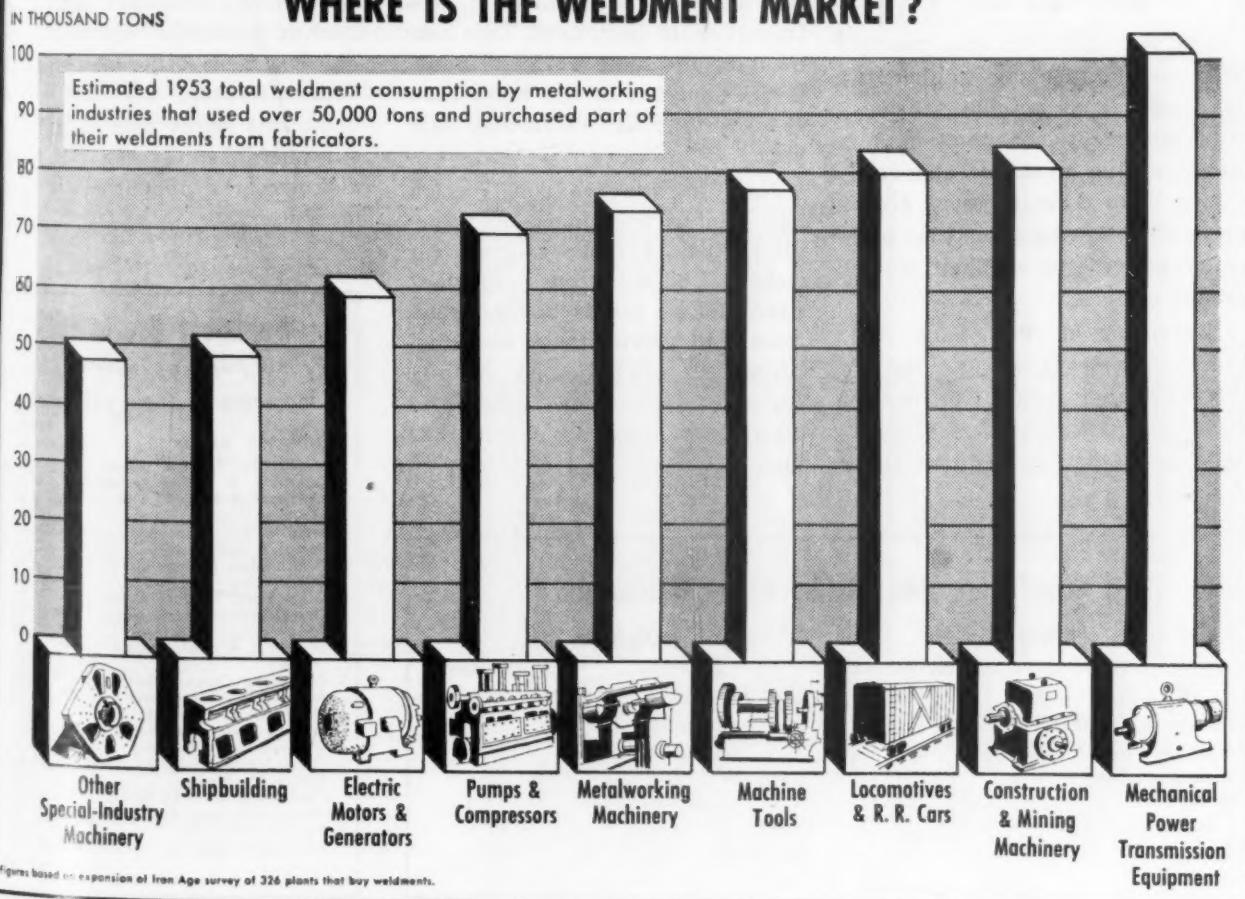
Not included in this impressive consumption figure are welded products such as ship hulls, auto chassis frames and bodies, tanks, welded pipe. The survey findings relate primarily to weldments in columns, bases, frames, housings and other machinery components involving built-up welded steel plates, often in combination with castings, forgings, bars, pipe.

Replies from 889 plants, which

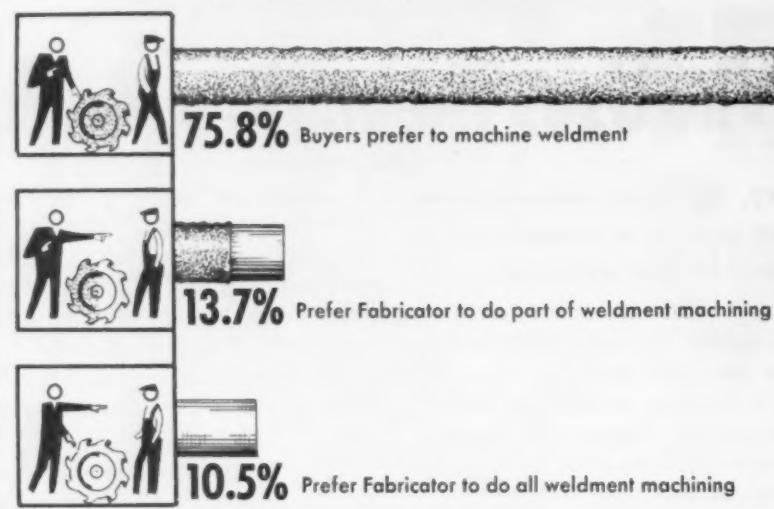
in terms of workers employed, represent more than a third of the machinery and equipment industry, point out that 77.3 pct of these plants use weldments in their products. Nearly half (47.4 pct) of the plants using weldments fill part or all of their demand from outside fabricators.

The survey indicates that larger plants are inclined to make all their own weldments, while smaller plants rely more frequently on outside fabricators. Of plants employing more than 1000 workers, only 34.6 pct purchased any of their weldments. Among firms with 500-999 workers, 45.3 pct buy from fabricators, while in the

WHERE IS THE WELDMENT MARKET?



Weldment Buyer Preferences on Machining



250-499 worker category, the figure is 47.5 pct.

Largest percentage buying some weldments (55.3 pct) is among plants with 100-249 workers. The figure drops to 44.3 pct for firms with 50-99 workers.

Who Uses Most

Despite indications that nearly half the plants using weldments buy some from outside fabricators, weldment consumption by plants making all their weldments is more than three times as great as consumption by firms that buy either all or part of their weldments.

Expansion of THE IRON AGE survey sample indicates that of the estimated total 1953 weldment consumption of 3.37 million tons, more than 2.6 million tons

will be used by manufacturers that make all their weldments. Use in plants buying part or all of their weldments is expected to be only about 764,360 tons.

Leading weldment consumers among the group that purchases some of its weldments are manufacturers of mechanical power transmission equipment. This segment of the metalworking industry is expected to use more than 104,000 tons of weldments this year.

Next in line are construction and mining machinery manufacturers, 84,314 tons; railroad car makers, 83,200 tons. Smallest users among plants buying weldments: industrial truck manufacturers, 95 tons; foundry machinery makers, 271 tons; builders of electric welding apparatus, 329 tons.

What Users Like, Dislike About Weldments

Likes	No. Plants	Dislikes	No. Plants
Less Expensive	225	More Expensive	23
Customers Like Them	151	Customers Dislike Them	7
Good Serviceability	130	Poor Serviceability	1
Lighter Weight	34	Corrosion	5
Better Appearance	28	Poor Appearance	9
Easier to Machine	26	Difficult to Machine	5
Stronger	25	Less Rigid	2

In replying to THE IRON AGE survey, metalworking manufacturers who buy weldments expressed definite preference for doing all the weldment machining themselves. Three-quarters (75.8 pct) of those responding said they prefer to do the complete machining job, while 13.7 pct want weldment fabricators to do part of the machining. Only 10.5 pct prefer fabricators to do all the machining.

Weldment Likes, Dislikes

Commenting on the main advantages of weldments, 225 manufacturers said they are less expensive than other joining methods. Favorable customer reaction was listed by 151 plants, good serviceability by 130 (see box). Other advantages mentioned fairly frequently were: durability, flexibility of design, no patterns required, faster delivery time.

Among the criticisms made, cost, rated as the main asset of weldments, also topped the list of disadvantages, being mentioned as a drawback by 23 plants. Poor appearance, customer resistance, loss of strength because of machining were other faults specified. However, the number of criticisms made totaled only 62, far outranked by the 728 favorable remarks submitted by weldment users.

Weldment Use in 1953

By metalworking industries buying some of their weldments

INDUSTRY GROUP	TONS USED
Mech. Pwr. Trmsn. Equip.	104,641
Constrctn. & Mining Mchry.	64,314
Locomotives & R. R. Cars	83,200
Machine Tools	80,043
Metalworking Machinery	76,519
Pumps & Compressors	72,677
Elec. Motors & Generators	61,929
Shipbuilding	51,932
Other Spec. Industry Mchry.	50,636
Other Genl. Industry Mchry.	32,548
Food Products Machinery	21,650
Engines & Turbines (except Air & Auto)	16,721
Conveyors, Cranes, Hoists	8,568
Paper & Pulp Machinery	6,168
Oil Field Machinery & Tools	5,461
Printing-Trades Machinery	2,842
Woodworking Machinery	2,175
Power Transformers	1,217
Textile Machinery	784
Commercial Laundry Mchry.	651
Electric Welding Apparatus	321
Foundry Machinery	271
Industrial Trucks	95
TOTAL	764,368

TIN: U. S. Surplus Looms Over Market

Bullish market reversed by news of 40,000-ton surplus over stockpile needs . . . RFC may sell it to industry . . . Magnitude dwarfs proposed buffer pool—By R. L. Hatschek.

What to do with some 40,000 tons of surplus tin is the puzzler facing Reconstruction Finance Corp. The world's tin traders are waiting apprehensively for RFC's solution.

Just the announcement of the surplus was enough to reverse a bullish market. Quotation the day before the announcement was 85.75¢ per lb—it dropped to 82.25¢ the day after. Just how to dispose of approximately an 8-month U. S. supply without causing complete collapse of the market is the crux of the problem.

Stockpile Overflows

The market had been riding fairly high on a report of possible U. S. aid for other commodities such as natural rubber and optimism emanating from the International Tin Conference at Geneva, Switzerland. Reports were that a 25,000-ton buffer pool would be set up to stabilize the market. A floor price for this of 87.50¢ per lb was said to be under consideration.

Actual facts, disclosed at the Geneva conference by U. S. Advisor Clarence W. Nichols, are that the U. S. will have by March 30,000 tons of metallic tin and 8000 to 10,000 tons of tin in concentrates over what is deemed necessary for the strategic stockpile. And it may be offered for sale before RFC is dissolved next June 30.

What Happened?

Most of this surplus has been acquired under contracts with Indonesia and the Belgian Congo at a price of \$1.21½ per lb. Other metal has been arriving from Bolivia at about the current market quotation.

How did the surplus get so big? RFC gives two reasons: (1) Private industry hasn't used so much tin as anticipated when the long term contracts were signed for 20,000 tons annually of Indonesian and 6000 to 7000 tons annually of Belgian Con-

go tin. Signing was early in 1952. And (2) the U. S. bought some 21,000 tons of Bolivian tin to aid that country's economy—not to bolster U. S. supply.

Officials point out that most tin purchase agreements expire or come up for renegotiation in March.

Could Close Mines

How much will this over-buying cost? Assuming no loss on Bolivian tin, there are at least 17,000 tons bought at \$1.21½ per lb to dispose of. If the market remains stable at about current levels, RFC would stand to lose about 40¢ per lb—some \$13.6 million. This would leave most of the expensive tin in the strategic stockpile.

This could be a potent argument for stockpiling when prices are down and markets are soft—instead of taking tonnages away from consumers and forcing prices higher in tight supply periods.

Opinion in some quarters is that this 40,000-ton surplus hanging over the market will knock prices so hard that many mines will have to halt production. This, according to one delegate at Geneva, would end in "a world shortage through which the U. S. could cash in."

Plain fact is that the tin market's worst problem is over-production. During the first 8 months of 1953 world figures, excluding Russia, show production of 121,600 long tons of tin metal and consumption of only 88,700 long tons. This is a repeat of the previous 5 years.

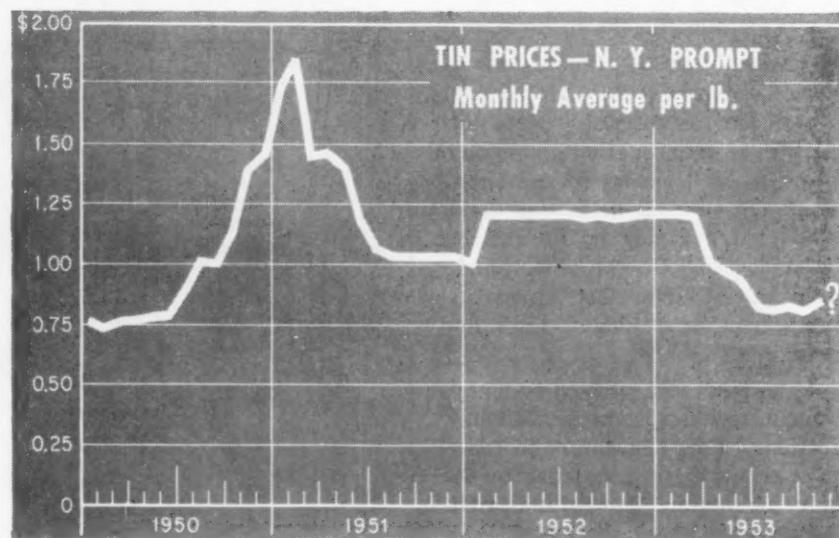
Short term outlook for the U. S. market is one of abstinence by consumers. Most buyers have comfortable tin inventories. Tinplate, which accounts for about a third of U. S. tin consumption, moved slowly during the second half of this year. Strikes at two big can companies may well extend this softness, retarding the first quarter seasonal upturn.

Purchasing men will take a wait-and-see attitude toward RFC disposition of the surplus. They figure that prices can only decline. The Geneva buffer pool was designed to prevent any price decline below current levels. But the 8-month magnitude of the U. S. surplus, if not handled carefully, is likely to demoralize the trade.

Spain to Buy Copper, Aluminum

Economic and military aid under the agreement with Spain got underway last week when the U. S. allotted slightly over \$2 million for purchases of copper, aluminum, and tinplate.

Largest of the authorizations was more than \$1.1 million for purchase of blister copper, none of which is to be bought from U. S.



FOREMEN: What Makes Them Happy?

Why foremen like, don't like their jobs . . . Better communications improves work satisfaction . . . Profile of the average foreman . . . What he makes—By K. W. Bennett.

Taft-Hartley helped put company foremen more solidly on the management team—but are they happy there?

Industrial management probed this question at a standing-room-only American Management Assn. meeting in Chicago last week.

Opinion Research Corp. reported that two out of three foremen polled find their relations with management "very good." Though the ratio represents a healthy improvement since the closing days of World War II, it nevertheless indicates there are more dissatisfied foremen today than 2 years ago.

What They Want

Who was dissatisfied? Greatest number were in three groups: First level foremen; foremen with less than 5 years tenure; and foremen in large plants employing more than 1000 workers.

Opinion Research's survey indicates clearly what foremen want from management: (1) Clear-cut statements defining where they stand in selecting, firing, transferring men, (2) Specific backing from management on their decisions, (3) Advance notice on changes and management attention to foremen and employee suggestions.

Communications Is Key

Foreman morale, climbing since World War II, could still be improved. For instance, only three out of ten foremen queried expressed optimism on "chances for advancement" and only one-half rated their companies favorably on "interest in its employees." On the other hand, three out of four liked steadiness in employment, and showed high interest in their jobs.

As pointed out, solution to many foreman troubles is "better communications." Foremen wanted to know more about their companies to do their job better. It was indicated that workers under them prefer to

get company information from the line foreman rather than from printed books or union officials.

Associated Industries of Cleveland presented facts on what the average foreman earns and gets in benefits. If he works in the Cleveland area, he probably earns about \$477.92 per month (a rise of 11.9 pct in 2 years), doesn't have to punch a time clock, doesn't have a company manual.

What Foreman Earns

His pay differential over the highest hourly-rated employee in his department averages about 20 pct, but can range from 7.5 pct to 50 pct. Odds are he's rated on a merit rating basis once or twice a year.

In three of five companies, the foreman is covered by special sick leave plans but does not participate in management insurance programs unless his company is large. Most get an extra week of vacation each year, are usually exempt from overtime pay but they may get some compensation when overtime is fairly regular.

The Cleveland survey covered 600 widely diversified industries and was regarded by management officials as a valuable guide.



"One of the old school."

Policy:

Survey 121 top executives on management's '54 plans.

What's the outlook for industry in 1954? What decisions will top management make on production, prices, buying policy?

Will industry spend more or less for expansion, research, maintenance, advertising, entertainment? What effect does anticipated expiration of excess profits tax have on planned action of top executives?

Quiz Top Management

These are questions asked of business leaders by consulting personnel of Turton Associates, a management consultant firm in Cleveland.

Personal interviews lasting from 1 to 4 hours were conducted with executives of 121 companies. Of the 121 executives, 87 pct were board chairmen, presidents, and treasurers.

Answers are given in percentages. But no question subjects are included on which fewer than 77 definite answers (equivalent to a return of 65 pct) were received.

Each of the 121 companies had in excess of 100 employees. Their representative nature is found in size and industry grouping. By size they were as follows:

100 - 500 Employees	45 pct
501 - 1,000	" 18 "
Over 1,000	" 37 "

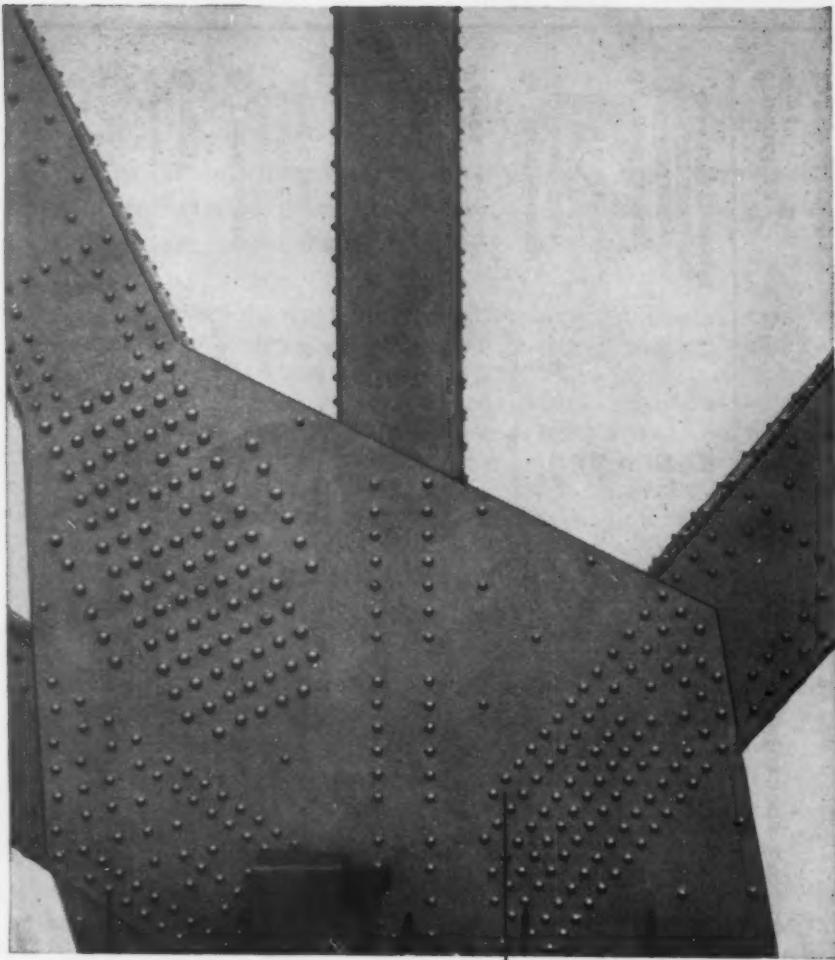
The manufacturing companies were classified in three industry groupings as follows:

Consumer Goods	23 pct
Industrial Equipment	33 "
Parts and Materials	44 "

Decisions executives expect to make on policy and spending during 1954 are tabulated for your convenience on the next page. Not shown are opinions on excess profits tax. Executives expect a new tax to replace it.

POLICY: What Changes Are Executives Planning?

Earnings		Modernization & Expansion Expenses			Advertising Expenses		
		Reduce	Maintain	Increase	Reduce	Maintain	Increase
By Type of Industry		72%	28%	0%	By Type of Industry	0%	55%
Consumer Goods	54	23	23	25	Industrial Equipment	55	45%
Industrial Equipment	55	20	25	25	Parts & Materials	24	33
Parts & Materials						76	0
By Size of Company					By Size of Company		
100-500 Employees	64	18	18	33	100-500 Employees	7	7
501-1000 Employees	56	22	22	30	501-1000 Employees	20	20
Over 1000 Employees	55	25	20	16	Over 1000 Employees	17	31
Prices		Inventory Expenses			Commercial Research Expenses		
		Reduce	Maintain	Increase	Reduce	Maintain	Increase
By Type of Industry		25%	42%	33%	By Type of Industry	73%	27%
Consumer Goods	17	66	17	45	Industrial Equipment	55	0%
Industrial Equipment	14	82	4	0	Parts & Materials	24	38
Parts & Materials							
By Size of Company					By Size of Company		
100-500 Employees	29	53	18	6	100-500 Employees	0	60
501-1000 Employees	10	90	0	0	501-1000 Employees	0	0
Over 1000 Employees	12	68	20	25	Over 1000 Employees	12	76
Production		Maintenance Expenses			Entertainment Expenses		
		Reduce	Maintain	Increase	Reduce	Maintain	Increase
By Type of Industry		53%	27%	20%	By Type of Industry	50%	40%
Consumer Goods	57	33	10	50	Industrial Equipment	44	6
Industrial Equipment	62	17	21	48	Parts & Materials	43	9
Parts & Materials							
By Size of Company					By Size of Company		
100-500 Employees	52	30	18	7	100-500 Employees	25	75
501-1000 Employees	50	20	30	25	501-1000 Employees	25	75
Over 1000 Employees	67	22	11	36	Over 1000 Employees	78	22
Product Diversification		Technical Research Expenses			Contributions Expenses		
		Reduce	Maintain	Increase	Reduce	Maintain	Increase
By Type of Industry		0%	100%	0%	By Type of Industry	40%	30%
Consumer Goods	6	77	17	55	Industrial Equipment	33	12
Industrial Equipment	4	78	18	68	Parts & Materials	26	6
Parts & Materials							
By Size of Company					By Size of Company		
100-500 Employees	6	69	25	54	100-500 Employees	55%	45%
501-1000 Employees	0	89	11	8	Industrial Equipment	63	0%
Over 1000 Employees	4	88	8	13	Parts & Materials	77	0



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Strike:

Steelworkers' strike against can firms pinches tinplate.

The United Steelworkers' strike against 63 plants of two major can companies may strike its first blow at tinplate production this week.

Pinched for warehouse space, some producers reportedly were making plans to curtail rolling of hot bands for tinplate as the initial step toward eventual stoppage of production. Tinplate is in process for from 2 to 3 weeks.

One source predicted that if the strike is not settled in 3 weeks half the tinplate mills of the country will have curtailed operations.

The mills are continuing shipments to non-struck plants of Continental Can Co. and American Can Co., but the tonnage is relatively small, and some producers which do not have orders from non-struck plants have been forced to suspend shipments.

The strike has put a premium on warehouse space of the producers. Some mills are arranging to provide additional room in the plants for stocking. One producer is planning to rearrange equipment for warehousing purposes.

Can They Agree?

Most mills were still producing normally last weekend.

The strike began at midnight Dec. 1 when the USW and the can companies were unable to reach agreement on union wage demands. The companies offered 8½¢ per hr pay raise, plus 2¢ per hr toward vacations and job rate adjustments.

A company announcement claimed the union's original demands amounted to a "package" of over 50¢ per hr but that subsequent negotiations had reduced the demands to the equivalent of 26¢ per hr.

When negotiations were broken off the union claimed it and the companies were 15¢ apart on money and that 65 issues remained unresolved.

GARAGES: Mechanized Car Parking

Pigeon Hole parking spreads . . . Eight now going up in U. S. . . Eleven already in use . . . Elevator moves horizontally, then stacks cars in proper tier—By T. M. Rohan.

Three years ago nobody thought you could park a car in a pigeon hole. But the Pigeon Hole parking system introduced then by Spokane Lumberman Leo Sanders is now relieving downtown parking congestion in 7 U. S. cities and Caracas with 11 units handling 1326 cars. Eight more are going up in 7 cities including the granddaddy of them all, a 312-car job in New York City.

Controlling interest in the firm was purchased recently by E. H. Robertson, Fort Worth, who plans to invest \$13 million in parking units in large cities during the next 18 months. When completed there will be space for a total of 18,000 cars.

The 11 up so far and 8 under construction are forming a unique new market for beams, structurals, angles and plates, using an average of about 0.97 tons per car.

Over, Then Up

The novel system consists of a steel framework up to 8 levels high and as long as available space will permit. Longest so far is wide enough for 27 cars. In

front of this is one or more elevators which run back and forth in front of the stalls on a track arrangement. Power comes from a 7.5-hp motor and chain drive.

For parking, cars, which can be locked first, are run directly onto the elevator. The elevator travels horizontally to the proper space, then lifts the car to the desired level in about 45-60 seconds. The car is lifted off the elevator bed by a vane-type hydraulic jack mechanism and moved into the stall. There it is let down and the jack withdrawn.

To take cars out the cycle is reversed: the jack snakes in under the car, lifts it up and out to the elevator bed.

Vertical lift is through a 50-hp motor and hydraulic mechanism. A cable and piston arrangement doubles the speed and height of lift. Elevators generally weigh about 20 tons, mostly steel beams with elaborate control and safety devices. A single operator rides the elevator.

Prices of the units vary considerably due to different foundations, height compared to width,

available area in which to work, etc., but are roughly around \$700 per stall. Pigeon Hole's home town of Spokane now has three completed and another one under way.

Others are up in Portland, Ore.; Boise, Idaho; Madison, Wis.; Phoenix, Ariz.; Rockford, Ill.; Los Angeles, and Caracas, Venezuela. Units under construction are the giant New York structure and others at Hartford, Youngstown, Buffalo, Tacoma, Reno, Nev., and Maracaibo and Caracas, Venezuela.

Boosts Operators' Profits

The Buffalo unit now under construction gives a general idea of the type of steel consumed. This 252-car unit used 245 tons. Breakdown is about 80 tons of plates in 18 and 22 ga and 3/16 in. sizes; 25 tons of 5x5 in. wide flange beams of 18.9 lb per ft.; 36.5 tons of horizontal supporting beams. Channels, anchors, plates, floor plate and trim account for the remainder.

Pigeon Hole usually sends out its own construction supervisor and a few assistants. Local construction firms and equipment are used.

One parking station operator who converted from conventional parking garage to Pigeon Hole increased monthly intake from normal \$2000 to \$3800 in the first month due to more cars handled.



PIGEON HOLE parking units at Portland (top). Hydraulic lift (right) parks cars at the new garage in Los Angeles. Only one operator is needed.



STEEL: Dimout for Electric Furnaces

Slump may end in early '54 . . . Output tumbles from peak 87 pct to 56 pct . . . Decline came when conversion waned, alloy market softened, military stretched orders—By J. B. Delaney.

Decline of electric furnace steel-making probably will not level off until the first quarter of 1954 when current inventory correction enters its final phase. Meanwhile, depressed electric furnace operating rates offset firmness of openhearth production and lower the overall ingot operating rate.

This electric furnace letdown was anticipated by producers who braced themselves when earlier this year overall steel supply began to balance with demand. First prop to be knocked out from under electric furnaces' high output rate was conversion steel, produced largely in this type of furnace. Shock No. 1 came in July, was followed by a worse one in September and a further dip last month.

Yet, loss of conversion business tells but part of the story. Equally to blame for the slump are the soft market for alloy and stainless steel and stretching of defense orders.

October electric furnace operations stood at 56.3 pct of capacity against a peak of 87.7 pct last

March. November production was certainly no improvement over October and may turn out to be worse.

Reason why the openhearth ingot rate is holding up so well is that demand for most openhearth tonnage products continues firm.

Openhearth rate in October was 99.1 pct of capacity, and from January through October it averaged 99.6 pct. Compare this with an electric furnace average through October of 76.5 pct.

Electric furnace production is expected to recover when inventory correction ends. This adjustment is likely to continue until early 1954. No one expects the rate to regain the peaks of the last 4 years—barring a sharp step-up in defense requirements or a temporary strike shortage of steel.

Actually, the present electric melting rate is not so bad in relation to the mushrooming growth of productive capacity. At 50 pct today, the industry is producing more electric furnace steel than it could turn out at 100 pct 6 years

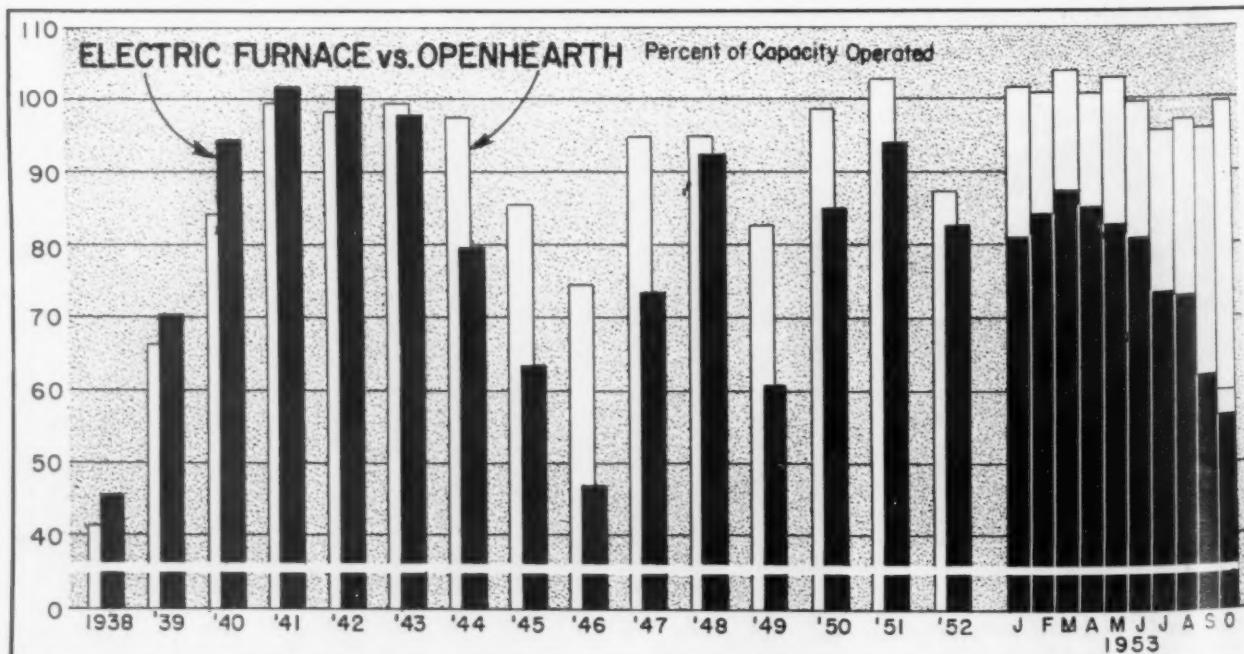
ago. Since 1947, capacity has more than doubled, climbing from 5.1 million tons to over 10.2 million.

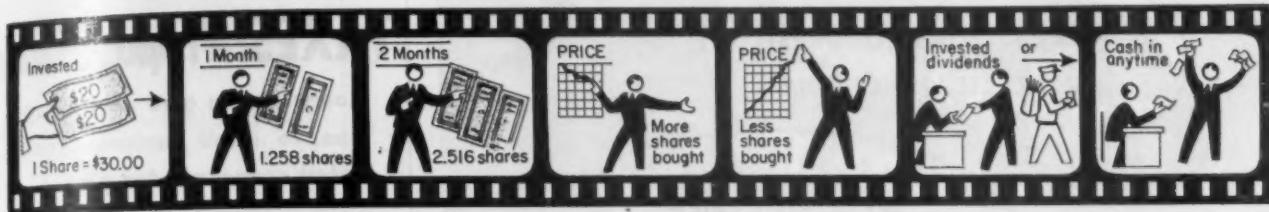
In a generally weak alloy steel market, mills are quoting 30-day delivery or better on some products. Longer production cycles are the only limiting factor on others.

Stretch-out of military programs has hit tank and aircraft production, both consumers of alloy. On the civilian side, severest blow to alloy demand is a combination of inventory correction and auto production cutbacks. Demand from farm implement manufacturers and diesel engine producers has eased.

Alloy shipments to forgers dropped sheerly. Most forgers had been accustomed to ordering 90 days ahead, and when the supply dam broke they were swamped with sudden delivery of 2 and 3 months' orders. Deluged with inventory and facing reduced automotive demand, forgers quickly cut off deliveries.

Stainless producers make no secret that business this quarter is shot, probably won't pick up much until first quarter. But they are not as depressed as their current ingot rate would indicate. Over the year, business has been good. In the first 9 months of 1953, the industry produced over 800,000 tons of stainless ingots, compared with 900,000 tons in entire 1952.





STOCKS: Sell on Installment Plan

New York Stock Exchange introduces plan for stock buying on time . . . Payments start at \$40 every 3 months . . . No extra commission charges, penalties—By G. G. Carr.

American industry itself will be sold on the installment plan if a newly announced New York Stock Exchange program lives up to expectations. The program, which takes effect Jan. 25, will permit the public to buy Big Board stocks through periodic cash payments.

Investors may buy securities through N. Y. S. E. member firms by making payments as small as \$40 every 3 months or as large as \$1000 monthly. No margin, contract, extra charges or any higher commission to the public is involved. The customer indicates he wishes to invest a certain sum regularly for a given period, is not penalized if he changes his mind.

How Plan Works

Aimed at the medium-income group, the plan applies to securities marketing the enforced savings method used so successfully to sell insurance and consumer durables. Admittedly set up to boost stock trading volume, the program should have the effect of markedly broadening the ownership of U. S. corporations.

The Stock Exchange offers this illustration of how the plan works:

Mr. Jones decides to invest \$40 a month in a stock selling for \$29 $\frac{1}{2}$ per share, or an odd-lot price of \$30. His broker deducts \$2.26, regular 6 pct commission on the \$37.74 balance, executes Mr. Jones' buy order in normal fashion. Mr. Jones immediately becomes the owner of one full share and \$7.74 of a second share—a total of 1.258 shares.

The second month he will own

two full shares (\$60) plus \$15.48 of a third share, making 2.516 shares. This assumes the price of his stock has not changed; if it has gone down, he can buy more shares, if up, less.

Mr. Jones has the option of plans ranging from 1 to 5 years. At the completion of whichever plan he selects, he receives a certificate of stock ownership from the company in which he invested.

Stock dividends and splits will be added to the shares already in his account. Rights to new issues may be either sold or reinvested. He's not penalized if he misses his payments for a month or two; his broker merely suspends buying.

Mr. Jones can either receive his dividends directly or ask his broker to invest them directly as received. If at any time he wants to get out, he merely stops payments. He may keep his stock or sell at the market. If he wishes to terminate the purchase plan and his holdings include a fractional share, he may either sell it through



his broker or ante up the money needed to make a full share.

In the works for months, the plan was perfected by two odd-lot houses, Carlisle & Jacquelin and De Coppet & Doremus. Brokers offering the plan to their customers will deal with these two houses, but must contact the public and sign up customers themselves.

The Stock Exchange itself is not sponsoring the plan, but is preparing descriptive booklet for distribution by member firms. The Exchange points out the centralized system is designed to keep costs down, allow member firms to handle small recurring transactions profitably at the usual commission.

An IRON AGE sampling of stock houses shows that Wall Street is generally enthusiastic about the program, believes it economically solid. Several houses indicated they will offer the plan as soon as possible. Coming in for a lot of discussion is the opportunity for employees of Big Board companies to invest in their own firms through the plan, possibly by payroll deductions.

Steel Investment Up 41 Pct

Investment in steel has nearly doubled since World War II, according to the American Iron and Steel Institute. While capacity of 44 steel firms representing 88 pct of U. S. capacity at the end of 1952 rose some 30 pct, total investment (total assets less current liabilities) climbed from \$4.4 billion to \$7.5.

Long term debt increased 167 pct to the record total of \$1.26 billion, nearly 17 pct of total investment at the end of 1952. During the same period book value of common stock increased 20 pct.

Another source of the increase was net income ploughed back. About 45 pct of earnings went into dividends paid out.

TAXES: Propose Cut

Congressmen give cool reception to small business graduated corporate tax plan.

Rumblings for small business tax relief were heard in New York last week as National Assn. of Independent Business (NAIB) advanced a plan for a graduated corporate income tax at a panel discussion attended by members of the House Ways & Means Committee.

Norman Redlich, chairman of the NAIB said small business must have a better break on taxes since it relies primarily on retained earnings for expansion and cannot obtain outside capital so easily as large corporations.

No Revenue Lost

Under the tax plan being championed by NAIB, the government would not suffer a loss of revenue, Mr. Redlich said. The revenue drop resulting from cuts in tax payments made by small corporations would be made up by higher taxes on large firms.

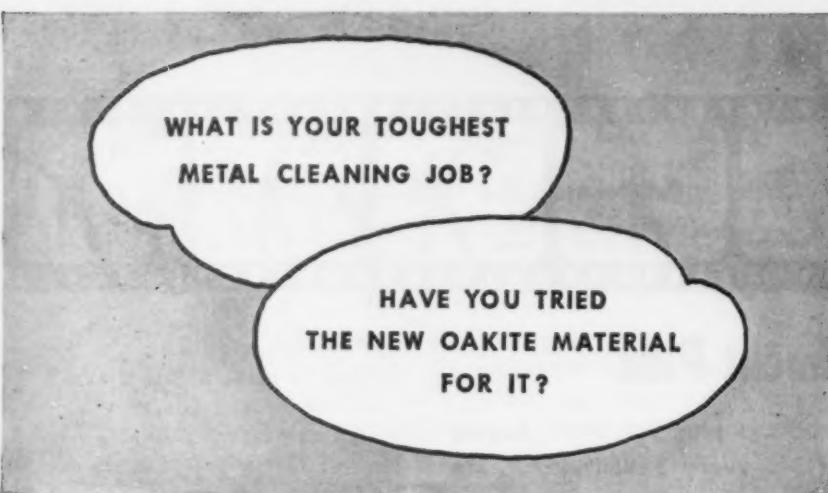
The proposal outlined by NAIB would change the current tax schedule this way:

CORPORATE NET INCOME	CURRENT TAX	NAIB TAX PLAN
Under \$25,000	30 pct	15 pct
\$25,000-50,000	52 pct	15 pct
\$50,000-100,000	52 pct	47 pct
\$100,000 and up	52 pct	55 pct

Reception of the proposal by House Ways & Means Committee members attending the meeting was cool. Rep. Robert Keen, R., N. J., said he believes the current tax of 52 pct on corporate income over \$100,000 is already too high and that raising the rate to 55 pct as proposed by NAIB, would only make the situation worse.

Daniel Smith, special assistant to the Treasury Secretary, said the NAIB graduated corporate income tax proposal was similar to the personal income tax approach and that there was no analogy between the two tax fields.

Speaking from the floor, a tax consultant for the National Assn. of Manufacturers said that most



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- 3 Washing in pressure-spray machines
- 4 Electrocleaning zinc-base die castings
- 5 Putting heavy zinc phosphate coatings on steel in preparation for painting
- 6 One-operation cleaning, pickling and conditioning for painting
- 7 Stripping paint
- 8 "Killing" paint in spray booth wash water
- 9 Drawing and forming

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ate for Small Firms

small businesses are not incorporated and that any efforts to relieve the tax burden should be made by reducing the "atrocious degree of progressiveness in individual income taxes," rather than changing the corporate tax structure.

Other members taking part in the panel discussion were Rep. Hale Boggs, D., La.; Rep. Antoni Sadak, R., Conn.; Professor John Hanna and Dean William Warren, Columbia University Law School, and Eli Mason, N. Y. State Society of Certified Public Accountants.

Study Easing SEC Requirements

Congressional support next year may be ample for a proposal to raise from \$300,000 to \$500,000 the amount of stock and bond issues which need not be registered with Securities & Exchange Commission.

"General agreement" on the worthwhile nature of this exemption was reached recently by stock exchange, investment group and SEC officials, according to Sen. Prescott Bush, R., Conn. He heads a Senate Banking subcommittee which is examining possible amendments to Securities Exchange Act.

Referring to the proposal, Sen. Bush said: "The decline in the value of the dollar since 1945 when the \$300,000 figure was specified makes the change at this time seem entirely reasonable. The SEC estimated that this would reduce the number of issues which would have to be registered by 5 or 6 pct."

He said the SEC, stock exchange and investment group officials, with whom he met in informal conference, were agreed that the increase "was in order and would be unlikely to meet with any objection."

Clear Out Obsolete Items

Putting into effect the old saw, "if you watch the pennies, the dollars will take care of themselves," Defense Secretary Wilson has handed down orders that any obsolete and other items no longer needed must be cleared out quickly.



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PLASTICS: "I Need a Desk Size Ingot"

Plastics molders use bigger dies, more of them . . . Buy more alloy steel blocks . . . Big die sets used in pairs . . . Form TV cabinets at a stroke . . . Where demand is—By K. W. Bennett.

"Your ingots aren't big enough," a buyer recently told an alloy steel producer. "I need something about desk size."

The buyer was a maker of molded plastics. His need for a larger alloy steel block stressed the size growth of dies used by the plastics industry. This and the use of more dies has caused a rise in consumption of alloy steel by plastics companies that has been as steady as a bamboo shoot.

Not too long ago a 3000-lb die drew whistles—but today 18,000-lb die sets are being used to form phenolic TV cabinets. These die sets are used not singly, but in pairs.

Industry 5000-Strong

Five years ago, the firm with the 18,000-lb die used six presses ranging in capacity from 500 to 750 tons each. Today, there are ten presses in full time operation, with the four additions beginning at 1250 tons capacity. As with compression molding, sizes of plastic moldings and dies needed to make them have been multiplying for both injection molding and low pressure molding (type used to produce plastic auto bodies).

Currently six large molders have a \$20 million investment in equip-

ment for large moldings and use 5 million lb of plastic each month. The U. S. plastics industry covers some 5000 companies. Of these, at least 1200 are plastics molders.

Where Volume Is

For pressure molding, alloy steel continues to be the die raw material. Meehanite is being used in low pressure moldings. Here the press acts to form fiber glass reinforced plastics, but its chief function is to supply heat which will "cure," or harden, the plastic over its fiber reinforcement.

Tool and die men who have seen volume of plastic-forming dies grow since the 1920's estimate that the greatest volume for plastic forming is in die weights of 150 lb to 2000 lb. These are often prepared by small die shops which buy their alloy steel from warehouse suppliers.

For the big die specialists, mill steel has been increasingly important. Heavy alloy plate and billet are needed in sizes that are, for all practical purposes, custom made.

Big dies are big business. The 18,000-lb die used to produce a 21-in. TV cabinet at a single stroke represented engineering work by four major companies. Crucible Steel Co. produced the 25,000-lb

ingot from which the die cavity was formed. Final weight of the forging was 18,960 lb, after annealing, scaling, and cropping.

The mold was then worked into final shape by Richard O. Schulz Co. and critical hardening operations were handled by Lindberg Steel Treating Co. Chicago Molded Products Corp. put the die to work producing Motorola television cabinets.

The veteran tool-and-die man expects to see increasing use of large dies for forming plastics. While individual dies may not get much bigger, more firms will use large dies. (Size is already a problem in cost and maintaining uniform ingot quality.) Automotive, appliance, and air conditioning are particularly strong bets.

Must Mass Produce

To be economical, large plastic forming dies must be used for production line quantities. A single die is expensive. Its life is long, but it must produce a considerable number of cabinets. Design change in the molding, which might make a die obsolete overnight, has been solved. The original die face can be altered to give the product a new look without incurring the cost of complete die replacement. But the die must be used in mass production to recover its initial cost.

The television industry, a major user of large plastic moldings, has indicated it will switch to a smaller cabinet with the advent of color television. Die makers and plastics shops aren't particularly worried.

Pressure from Parts

They predict that big dies will be back in television within a short period. In the meantime, parts for refrigerators, air conditioners, and washing machines are increasing pressure on the heavy press capacity for forming plastics.

If 1953 registers a slight setback, die men feel it will be temporary. If they are forecasting correctly, they'll be buying increasing tonnages of alloy steel, especially in the heavier shapes.

Fabricated Structural Steel Contracts, Shipments, Backlog

	Estimated Net Tons		
	1953	1952	Avg. 1947-50
CONTRACTS CLOSED			
October	191,180	184,331	223,280
Year to Date	2,429,374	2,123,256	1,967,748
SHIPMENTS			
October	289,755	262,730	185,785
Year to Date	2,587,237	2,215,432	1,874,908
BACKLOG	1,927,240	2,266,875	1,364,772

Source: American Institute of Steel Construction

WRITEOFFS: You Can Still Get Some

Government still issuing certificates of necessity for 68 items needed for defense . . . Close down fast tax write-offs for 120 other categories—By A. K. Rannells.

You can still get fast tax write-offs on industrial expansion for production of 68 items needed for defense (see accompanying list.) Goods on which the government is still inviting applications for certificates of necessity range from commercial aircraft and freight cars to ammunition boxes and compressed gas cylinders.

Reviews Entire Program

Expansion inducement is also offered on a number of ores, minerals, and basic metal products.

New invitation to expand defense production facilities was issued at a press conference last week by Arthur S. Flemming, director of Office of Defense Mobilization. Mr. Flemming reviewed the status of 237 items in the defense expansion program, dividing them into three lists.

List I, Closed . . . Expansion goals have been reached on 120 items in this list. No more certificates of necessity will be issued. This represents no change in policy, as applications for fast tax writeoffs had been turned down in the past when expansion goals were already subscribed.

List II, Suspended . . . ODM has stopped issuing tax certificates on 19 items pending decision on whether additional expansion is needed. This means ODM is reviewing these programs in light of changing developments, will not approve any additional writeoffs until studies are completed.

List II includes machine tools, as well as metal cutting tools and metalworking equipment.

List III, Open . . . A total of 68 categories are still eligible for certificates, even though in some cases original goals have been fully subscribed. In a majority of

these programs, however, from 5 to 60 pct of the goals are still to be met.

Programs where goals have been met but which are still eligible for certificates include iron ore, metallurgical grade chromite, lead, zinc, molybdenum, antimony, mercury, and others. It is hoped that more domestic sources will be developed.

A thumbnail summary of selected categories on List III where goals are under-subscribed follows:

Heavy Steel Plate (over 20,000 lb)—Newly established. No in-

formation available last week as to goal or target date.

Steel Castings—Goal was increase of 500,000 tons in new capacity, bringing industry total to 3 million net tons by 1954. About 93 pct subscribed.

Gray Iron Castings (over 3000 lb)—Goal 160,000 tons new capacity by June 1954 for industry total of 16 million. About 5 pct subscribed.

Electrolytic Tinplate Facilities—Goal 2.8 million tons new capacity, bringing industry total to 4.5 million tons by 1954. About 93 pct subscribed.

Wide Flange Structural Shapes—Increase 850,000 tons sought, bringing industry capacity to 2.8 million tons by July 1955. Program 83 pct subscribed.

Grain-Oriented Silicon Sheet—Boost of 65,000 tons sought, bringing industry total to 215,000 tons.

You Can Still Get Fast Tax Writeoffs on These

Subject	Estimated Pct Subscribed	Subject	Estimated Pct Subscribed
Aircraft, Commercial	95	Inland Waterway Vessels (Specified Types)	53
Alkylate	57	Iron Ore	100*
Alumina	84	Iron Ore (Taconite)	30
Aluminum, primary	88	Laboratories, R & D	Not applicable
Aluminum Sheet, Plate, Heat Treat Fac.	48	Lead	100*
Aluminum Sheet, Plate, Producing Fac.	97	Locomotives, Diesel	61
Ammunition Metal Boxes, 30, 50 cal.	26.4	Manganese Ore, Battery & Chemical Grades	70
Antimony	100*	Manganese Ore, Metallurgical Grade	100*
Asbestos, Chrysotile, Strategic Grades	40	Mercury	100*
Barite	100*	Metal Can Manufacture—Tin Conservation	59.9
Bauxite	100*	Military Photographic Equip.	55.6
Beryl	70	Molybdenum	100*
Boilers, Steam	85.5	Natural Gas Liquids Capacity	30
Casting Steel	93	Nickel	80
Chromite (Chemical Grade)	40	Oil (Crude) Refining Fac. (Domestic)	30
Chromite (Metallurgical Grade)	100*	Oil Pipe Lines (Domestic)	63
Chromite (Refractory Grade)	100*	Oil Storage Facilities (Domestic)	25
Cobalt	80	Ore Carriers, Great Lakes	50
Coal, Metallurgical for Byproduct Coke	100*	Ore Carriers, Ocean Going	3
Coke—Byproduct	95	Rare earths	100*
Columbite & Tantalite Ores	100*	Rutile	100*
Copper	100*	Scientific Instruments	65
Cryolite, Synthetic	40	Selenium	70
Cylinders, Compressed Gas	52.1	Steel Sheets, Grain-Oriented Structural Shapes, Wide Flange	97
Electrolytic Tinplate	93	Tankers, Ocean-Going	26
Electronic Products, Military	77	Tampered Aluminum Sheet	30
Fluorspar, Acid Grade	100*	Tires (Specific Types)	98
Freight Cars	69	Titanium Metal	50
Gas Pipe (Large) Lines Laid	27	Transformers, Distribution	85.7
Gas Pipe (Small) Lines Laid	24	Tungsten Ore	100*
Gray Iron Castings (over 3000 lb)	5	Turbines, Steam	49.2
Heavy Aluminum Aircraft Forgings	50	Welded Aluminum Tubing	74
Heavy Steel Plate (over 20,000 lb)	New Goal	Zinc	100*
High Voltage Switchgear	83.9		

*Some goals 100 pct subscribed from foreign and domestic sources combined have been left "open" to facilitate increased domestic output.

Military Budget:

Economizers aim at \$31 billion defense budget—a 10 pct cut.

Defense Secretary Wilson last week indicated that attempt is being made to whittle new defense budget requests down to a figure around \$31 billion—about \$3.5 billion less than appropriated by Congress for the current fiscal year.

This would be a 10 pct reduction across the board. But Mr. Wilson isn't at all sure this can be accomplished.

Current defense budget proposals have not yet been rounded out into a figure for submission to the White House. Departmental deadline was Dec. 1 and it is expected that the overall figure will be ready shortly.

No comment can be obtained as to how much the Defense Dept. estimates its actual expenditures for 1954-55 fiscal year will drop below the current expectation of \$42 billion for 1953-54.

But Mr. Wilson has indicated that he doesn't expect military build-up to level off much for another 2 to 3 years. After that, all services will

be pretty much on a maintenance basis.

Both Army and Navy are nearing the leveling off stage, it is indicated. But Air Force has a long way to go.

Part of the expected budget reduction will be brought about by cuts in military manpower, particularly in the Army which has been given a flat figure of 10 pct.

Reason for Army taking the brunt is that most of the cuts would come from supporting troops.

Bulk of these are in Army units. Of the present 1.5 million men in Army uniform, only about 600,000 are in combat units. A cut of 110,000 had already been slated. Maintenance costs will also go down slightly with reduction of Army personnel to around 1.3 million.

But the bulk of the remainder must come from tightening purse strings within individual services.

Deny U. S. Cars Are Sent to China

Allegations that "many" new American cars have appeared in Red China are labeled untrue by the State Dept.

No automobiles have been cleared for export to the Communist-held country since Jan. 1, 1950, a spokes-

man for the department said recently. Washington representative of the auto builders also emphasize that their companies have adhered strictly to terms of the export ban.

These statements followed the contention, voiced by a Labor member of the British Parliament that there are as many new American cars in Peiping, China, as in the center of London. He inquired of his government what it intended to do about the alleged situation.

"Since 1949," according to the State Dept., "export licenses for used automobiles sent to any section of the Soviet bloc total 10. These licenses have been granted to U. S. official personnel and to personnel of friendly foreign missions only."

None of the licenses, it was understood, authorized shipment to Red China.

Contracts Reported Last Week

Including description, quantity, dollar values, contractor and address. Italics indicate small business representatives.

Fabricated steel cargo shipping containers, 1100, \$236,500, Jeta Metal Fabricator Inc., Yonkers, N. Y.

Arming mechanism for guided missiles, 1192, \$117,495, M. H. Rhodes, Inc., Hartford, Conn.

Shell M mortar, 250000, \$350,000, U. Machine Div., Stewart-Warner Corp., Lebanon, Ind.

Case, cartridge, brass, M19, 90 M10000, \$263,000, Globe American Corp., Kokomo, Ind.

Disc, brass, 90 MM, 100000, \$267,000, Bridgeport Brass Co., Bridgeport, Conn.

Diesel/generator set, 16, \$62,632, Hall Mfg. Co., Inglewood, Calif.

Motor generator frequency regulator, 20, \$92,400, Vickers Electric Div., St. Louis, Mo.

Repair parts for diesel engines, 27, \$52,520, General Motors Corp., Cleveland Diesel Engine Div., Cleveland, Ohio, and Chicago.

Special tools, \$485,490, Minneapolis Honeywell Regulator Co., Minneapolis, Minn., S. F. Keating.

Mobile trainer unit, \$150,000, North American Aircraft, Inc., Hawthorne, Calif.

Amplifiers, 1242, \$345,865, Sperry Gyroscope Co. Div., Sperry Corp., Great Neck, N. Y., George A. Dennis.

Special tools and test equipment, \$12,220, Bendix Aviation Corp., Eclipse-Plane Div., Teterboro, N. J., F. A. Battell.

Valves, 4129 ea, \$134,274, P. & H. Valves Inc., Long Beach, Calif.

Parts for engines, var., \$265,585, Bectilla Magneto Div., Bendix Aviation Corp., Sidney, N. Y., A. W. Dietrich.

Valve, hydraulic, var., \$52,776, Adelvision of General Metals Corp., Burbank, Calif.

Material for R4360-59 engines, var., 367, United Aircraft Corp.

Material for use on R4360-59 engines, var., \$2,100,388, United Aircraft Corp., Pratt & Whitney Aircraft Div., East Hartford, Conn., E. E. Champion.

Spare parts used on P & W engines, \$187,531, United Aircraft Corp., Pratt & Whitney Aircraft Div., East Hartford, Conn., E. E. Champion.

Material for J57-P-1 engines, var., 563, United Aircraft Corp., Pratt & Whitney Div., East Hartford, Conn., E. E. Champion.

IRON & STEEL: October Output By Districts

As Reported to the American Iron and Steel Institute

DISTRICTS	BLAST FURNACE —NET TONS	Annual Capacity	PIG IRON		FERROMANG., SPIEGEL & SILVERY IRON		TOTAL		Pet of Capacity
			Oct.	Year to Date	Oct.	Year to Date	Oct.	Year to Date	
Eastern	16,312,990	1,311,268	12,281,899	25,974	278,244	1,337,242	12,560,143	98.5	92.4
Pitts.-Yngtn.	28,643,120	2,296,363	22,882,959	34,198	345,949	2,330,561	23,228,908	95.8	97.4
Cleve.-Detroit	8,633,800	696,628	7,066,130			696,628	7,066,130	95.0	98.3
Chicago	16,251,250	1,306,980	13,115,396	11,071	22,528	1,318,051	13,137,924	95.5	97.1
Southern	8,020,380	474,179	4,668,160	6,715	480,894	4,747,679	94.0	94.7	
Western	3,518,700	334,334	3,260,535			334,334	3,260,535	111.8	111.2
TOTAL	79,380,240	6,419,752	63,275,079	77,958	726,240	6,497,710	64,001,319	98.3	96.8

DISTRICTS	STEEL —NET TONS	Annual Capacity	TOTAL STEEL*			ALLOY STEEL		HOT TOPPED CARBON INGOTS	
			Oct.	Year to Date	Pct of Capacity	Oct.	Year to Date	Oct.	Year to Date
Eastern	23,863,810	2,016,598	19,024,220	99.5	95.7	97,008	1,521,931	382,903	3,751,411
Pitts.-Yngtn.	43,621,000	3,416,002	35,247,457	92.2	97.0	403,654	5,210,956	402,470	4,467,794
Cleve.-Detroit	12,002,900	947,322	9,489,549	92.9	94.9	52,624	782,300	65,537	837,755
Chicago	24,960,600	2,029,365	20,633,619	95.7	99.2	97,813	1,432,771	273,138	3,160,195
Southern	6,036,160	507,604	4,850,047	99.0	96.5	3,178	47,088	8,425	56,759
Western	7,063,000	545,830	5,728,447	91.0	97.4	8,503	112,433	23,521	267,532
TOTAL	117,547,470	9,462,722	94,073,339	94.7	97.0	662,780	9,107,479	1,135,992	12,541,446

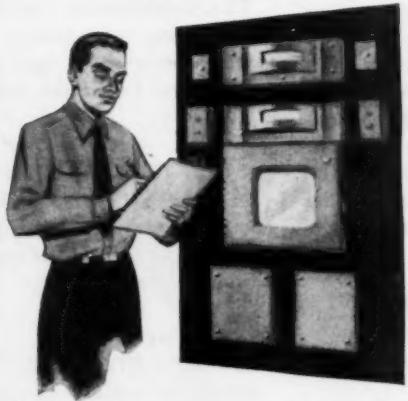
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Name _____

Company Name _____

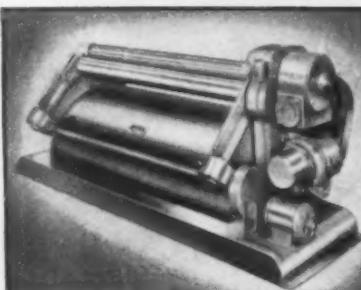
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**Modern
Metalworking
Equipment**

- BENDING ROLLS
- TURNING ROLLS
- AUTOMATIC WELDING FIXTURES



REED PLATE BENDING ROLLS

- ★ In 18 models, ranging from 3 ft. x 10 ga. to 8 ft. x 1/4" in capacity
- ★ Rugged, all steel construction
- ★ Built-in, silent worm gear drive
- ★ Durable, special bronze bearings
- ★ Power adjustment & air drop end available on most models



REED WELDING POSITIONER

- ★ Machined face with cast-in "T" slots
- ★ Machine Tool accuracy
- ★ 10-to-1 speed variation
- ★ Ball bearing work table mounting
- ★ 1000, 2500 lb. models, hand or power tilting
- ★ Rotating ground connection

WE INVITE YOU . . .
to write us for specifications, prices,
list of REED users near you. No obli-
gation. Just write on your letterhead.

REED ENGINEERING CO.

1006 W. FAIRVIEW, CARTHAGE, MISSOURI

Industrial Briefs

New Prexy . . . THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS elected Lewis K. Silcox, honorary vice-chairman of the board, New York Air Brake Co., as president for 1954 at its annual meeting last week.

Record Year . . . Canadian mining continues to expand and set new production records both in volume and value. Mineral output, now firmly entrenched above the billion dollar level, will be close to \$1.3 billion in 1953.

Clear Water . . . OHIO RIVER VALLEY WATER SANITATION COMMISSION has found that cleaner streams in the Ohio River Valley are becoming a reality, according to the commission's 5th annual report.

More Space . . . OLIN INDUSTRIES, INC., Ill., has moved its Purchasing Dept. from its East Alton plant to new and larger quarters at 1856 E. Broadway, Alton.

Going Up . . . THE NATIONAL SUPPLY CO. expects to start construction work this month on its new plant at Gainesville, Tex. Brown and Root, Inc., Houston, has been awarded the general construction of the plant.

Coming Up . . . SOCIETY FOR ADVANCEMENT OF MANAGEMENT's Philadelphia Chapter will hold its annual conference on Feb. 12, 1954, at the Benjamin Franklin Hotel, Philadelphia.

Distributor Named . . . THE BERYLLIUM CORP., Reading, Pa., has appointed New York Brass & Copper Co., New York, as a warehouse distributor for its wrought beryllium-copper products in the metropolitan New York area.

Dayton Office . . . HORTON CHUCK, Windsor Locks, Conn., reports that its representative, The Donald B. Hunting Co., Cincinnati, has opened an office at 1904 Brown St., Dayton.

Elected . . . THE CHICAGO FOUNDRYMEN'S ASSN. has elected Carl A. Larson, partner of the Reliance Pattern Works, as its president.

Appointed . . . REYNOLDS METALS CO., Louisville, has appointed Kasle Steel Corp., Cleveland, as its distributor for aluminum mill products.

Acquired . . . H. K. PORTER CO., INC., Pittsburgh, has acquired The Alloy Metal Wire Co., Pennsylvania.

Any Bidders . . . LUKENS STEEL CO. opened bids last week on the first construction phase of the \$10,500,000 armor plate heat-treating plant and allied facilities to be built on Lukens property.

Will Build . . . RUST FURNACE CO., Pittsburgh, will design and construct a new slab heating furnace and five batteries of soaking pits for Mc-Louth Steel Corp. at its Trenton, Mich., plant.

New Home . . . FOUNDRY SERVICES INC. has moved its home office from 280 Madison Ave., New York, to larger offices at 260 Madison Ave.

New Pipeline . . . TEXAS GAS TRANSMISSION CORP., Owensboro, Ky., plans to construct new pipeline and compressor facilities between Memphis, Tennessee, and Slaughters, Kentucky.

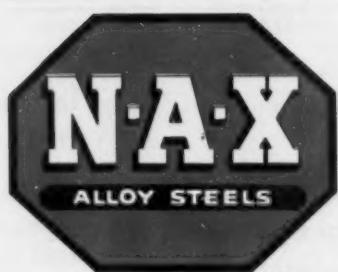
Hear Ye . . . UNITED STATES STEEL SUPPLY DIV. has been named by A. O. Smith Corp. of Milwaukee as its West Coast distributor for welding products.

Training Program . . . AMERICAN SOCIETY FOR METALS has established a nationwide training program for teachers of vocational and skilled trades.

Gets Contract . . . SELAS CORP. OF AMERICA has been awarded a contract by Phoenix Iron & Steel Co., subsidiary of Barium Steel Corp., for a continuous reheating furnace for seamless pipe, prior to sizing.

Gets Contract . . . LURIA ENGINEERING CO., Bethlehem, Pa., has been awarded a contract by the Nitrogen Div. of Allied Chemical & Dye Corp. for the construction of a 14,400-sq-ft standardized steel warehouse at its plant in South Point, O.

Exec Named . . . THE MAGNESIUM ASSN., New York, has appointed Jerry Singleton as executive secretary. He will join the Association on Jan. 1 at its executive offices at 122 E. 42nd St., New York.



MODERN STEELS for MODERN TRANSPORTATION

- **N-A-X HIGH-TENSILE** steel—a low-alloy high strength structural steel used to reduce weight and increase life of your product.
- **N-A-X AC 9115** steel—for gas turbines and similar products requiring strength of material when operated at higher than normal temperatures up to 1000°F.
- **N-A-X 9100** series—alloy steels for carburizing and heat treated parts. With these three N-A-X ALLOY STEELS, we offer time proven products to economically serve you.

N-A-X HIGH-TENSILE is 50% stronger than mild carbon steel with high notch toughness. Has excellent cold forming and welding properties and greater resistance to atmospheric corrosion and abrasion.

N-A-X AC 9115—a steel easily fabricated and welded by any method, maintains high strength at elevated temperatures up to 1000°F. When protected against high temperature oxidation by proper coatings, it is a worthy alternate for the higher-alloy stainless type steels for this application.

N-A-X 9100 series—a series of alloy steels with the alloying elements constant within an established range, with carbon varied to suit the hardenability and hardness desired. An outstanding carburizing steel.

GREAT LAKES STEEL CORPORATION

N-A-X Alloy Division

Ecorse, Detroit 29, Mich.

NATIONAL STEEL CORPORATION



The Automotive Assembly Line

Transmissions Boost Tooling Costs

Number, complexity of automatic transmission parts brings tooling cost equal to engines . . . Keep figures confidential . . . Prohibitive for most independents—By R. D. Raddant.

Next to the threat of fading sales, the biggest concern of automakers is the astronomical cost of tooling. Any major development, whether in body or engine, is coupled with untold millions in tooling costs.

"Untold" is literally correct, too. No automaker these days will permit the cost of tooling up for any project to pass his lips where it may be quoted or printed. As a result, tooling costs of any new engine, body or transmission are strictly in the estimated class.

Just As Expensive . . . Until the advent of automatic transmissions, however, large tooling bills were attributed to body or engine changes. Today, however, the cost of tooling for automatic transmission production large enough to serve several large divisions is comparable to that of tooling up for a new engine.

General Motors admitted that the loss of the Detroit Transmission plant in the fire last August probably went between \$50 million and \$60 million. Officials of Chrysler Corp. admit that the cost of tooling for the new PowerFlite is in "the same general field" as tooling for a new engine.

Parts Many, Complex . . . Reason is the number and the nature of the transmission parts which, in proportion to size, are as complex and delicate as those of a watch. Dodge Div., which manufactures all PowerFlites at Indianapolis, installed several thousand machine tools, many of them special tools and transfer machines, to reach a production potential of 2400 transmissions a day. GM pulled something like

6000 charred and burned tools out of the Detroit Transmission plant wreckage where Hydra-Matics were produced.

That is why many of the independents just can't afford to build their own transmissions when they can't even make the jump to V-8 engines. Packard's excellent Ultramatic transmission is the exception.

Shifts Change Slowly . . . Even Ford depends on Borg-Warner for 50 pct of its transmissions, but in return B-W has to demand a long-term contract to assure writing off its own tooling costs.

Upshot is that new automatic transmissions won't come and go at the whim of auto engineers. A transmission will absorb the same years of development and the same care in arriving at a design that engines have received. When once accepted and introduced it must

stand the test of a minimum of 5 to 10 years.

Mercury Shifts V-8 . . . Most new V-8 engines that have been introduced in the recent trend to the overhead valve, high compression engine have replaced straight 8's. These heavyweights powered their respective lines over millions of honorable miles for as long as two decades before yielding to lighter, more efficient V-8 engines.

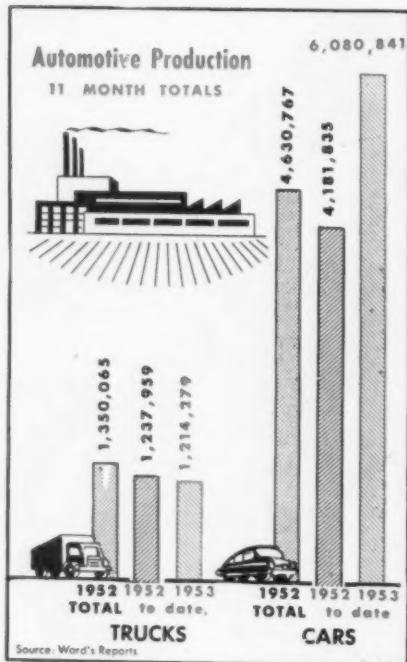
But Mercury's new powerplant appearing with the '54s replaces another V-8 that has powered Mercury since it was created as Ford's challenge in the medium price class.

How It Differs . . . A look under the hood of a 1954 Mercury shows what had to be done in building a new engine to bring it up to or ahead of the standards of competition in the price class. It also affords a possible preview of the new Ford engine that is generally expected to be a smaller version of the Mercury.

Statistically, the new overhead valve Mercury engine produces 161 hp, 36 more than its L-head predecessor. The bore and stroke are 3.62 in. and 3.1 in. respectively, which reduces piston travel 22 pct by the shorter stroke and larger bore.

By standards of some other V-8 engines, the compression ratio of 7.5 to 1 is low. (It approaches 9 to 1 in some others which employ a 12v battery and electrical system). It is obvious to any neophyte that this means the engine has a reservoir of untapped power should competitive conditions make a boost necessary.

Develops Less Friction . . . The new engine is more rigid than its predecessor, and its engineers contend that it has been made more efficient by reducing internal friction. The engine has a stronger yet lighter crankshaft with five main bearings compared to three



in the 1953 L-head. Crankshaft is precision molded of alloy iron and is superior in resistance to torsional vibration. A new four-barrel carburetor is also used on the engine with the second two barrels vacuum controlled.

Other features of the engine are: Valve guides cast integral with cylinder heads to reduce valve temperatures; balanced length intake manifold passages; full-flow oil filter; high turbulence wedge-shape combustion chambers; valve rotators on all valves; autothermic aluminum alloy pistons with chrome-plated rings.

See-Thru Top . . . Big note in Mercury styling, which in most models was not greatly changed from 1953 except for chrome and interior improvements, is something entirely new, a model with a transparent roof.

Only the front half of the top is made of transparent plexiglas. The $\frac{1}{4}$ in. thick section of plexiglas is tinted green to minimize light glare and heat. Because of the necessity of the green tint, only two color combinations are offered, one of two-tone green, the other a yellow-green combination.

Detroit Notebook . . .

Packard's 1954 engine will reach 212 hp, placing it ahead of Lincoln's 205. Chrysler has also introduced its 1954 cars with 235 hp. Cadillac is still to be heard from in the horsepower race.

General Motors will again take its Motorama extravaganza on the road in 1954, opening up in New York Jan. 21-26 at the Waldorf-Astoria Hotel. It will move to Miami for the week following Feb. 6, to Los Angeles Mar. 6, and San Francisco Mar. 27.

Blitz sales and razzle-dazzle merchandising may not please either the dealer or the manufacturer, but they do show results in terms of unit sales. In October, when blitz selling became nearly general, total sales reached 620,588 units, an 8.2 pct jump from September. Average for the first 10 months, however, was 639,265.

Sales:

Automakers' predictions put new stress on competition.

This is the time of the year when auto executives make their annual predictions about the forthcoming months but automotive writers and no doubt readers are getting tired of hearing that industry is "optimistic" and we "expect a very good year for 1954."

Some new versions were heard last week from Ivan L. Wiles, general manager of Buick, who declined to talk at all about "the industry." Instead, he confined his predictions to Buick. He said his division is shooting for sales of at least $\frac{1}{2}$ million cars, which would be about 20,000 more than 1953 but less than the 1950 record of 556,000.

While this is a remarkably optimistic prediction for his division, it is a strong implication of the changing competitive philosophy. Instead of worrying about "the industry" each divi-

Automotive Production

(U. S. and Canada Combined)

WEEK ENDING	CARS	TRUCKS
Dec. 5, 1953	101,896*	22,343*
Nov. 28, 1953	56,127	18,162
Dec. 6, 1952	98,505	30,500
Nov. 29, 1952	86,659	27,656

*Estimated. Source: Ward's Reports

sion or company must take care of its own business first.

James J. Nance, president of Packard, calls 1954 "the most critical year of the next 5 years." He believes that our economy "has reached one of those turning points that only happen once or twice in each business generation."

While not commenting on any specific rumors involving Packard in a merger with other independents, Mr. Nance declared that "my whole concern is to make Packard a more attractive bride." He has for some time contended that any successful merger of independents must involve Packard as the only high price auto producer among the independents.

By J. R. Williams



Latrobe

first again!

THIS TIME...IT'S

XL HIGH SPEED TOOL STEELS*

regular analysis high speed steels

...plus...

NEW SULPHIDE LUBRICANTS

...Additives
made possible

by the "DESEGATIZED" process
now available in M-1, M-2 and M-10 types

*Lower Costs through
Higher Production*

Contact your local Latrobe
representative for further information.

*Patent applied for.

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SALES AGENTS
DALLAS DENVER HOUSTON SALT LAKE CITY SEATTLE WICHITA

EUROPEAN OFFICES IN
GENEVA BRUSSELS MILAN PARIS ROTTERDAM

This Week in Washington

Way Clear for Some Depreciation Relief

Dropping balanced budget hopes seen paving way for easing depreciation . . . May exempt 1 million from filing income tax estimates . . . Foreign aid ripe for axe—By G. H. Baker.

Now that both the Administration and the Congress agree a balanced budget for fiscal 1955 is an "impossibility," there is greater reason to believe that easier depreciation allowances on machine tools, machinery, and other plant equipment may be written into the new tax law next year.

Rep. Richard M. Simpson, R., Pa., a member of the tax-writing House Ways and Means Committee, believes the decision to forego a balanced budget next year has paved the way for more liberal amortization rates.

But he points out that if either the White House or Congress should change its position and insist on a balanced budget, all tax reduction and tax benefit plans will be in jeopardy.

Depreciation Change . . . As Mr. Simpson sees it, next year's omnibus tax bill probably will include authorization for firms to write off their new equipment at the rate of 20 pct for the first year and 20 pct of the balance in each of the succeeding 4 years.

Under existing Treasury rules, equipment must be amortized over a period of time corresponding roughly to the anticipated period of usefulness. This period is often reckoned to be 20 years, and is as high as 30 years in some cases.

Both Treasury and congressional tax experts believe the immediate effect of rapid amortization is a loss of revenue to the government. But, it is reasoned, part or all of this loss is made up in the long run because companies are encouraged to replace their machinery and equipment at more frequent intervals, thus stimulating a healthy degree of activity in the machinery trades. It can then

be logically reasoned that corporate tax revenues will rise over the long pull, due to the higher level of business.

Broaden Exemptions . . . Congressional tax-writers are talking about exempting more than 1 million persons from filing income tax estimates. Under present plans, single persons with incomes of less than \$5000 annually would be exempted from filing estimates, and married persons with incomes of less than \$10,000 annually would be similarly exempted. The exemptions would apply only to income subject to withholding.

Treasury officials are in agreement with congressional revenue experts on this plan, which is now slated for inclusion in the omnibus tax bill due to be reported by the House Ways and Means Committee next year.

Uniform Cost Accounting . . . Federal Trade Commission's drive for adoption by industry of uniform methods of cost accounting is off and rolling this week with an open invitation to accountants to submit their views on uniform

systems of measuring business costs.

Prof. H. F. Taggart, of the University of Michigan, is serving as chairman of the advisory committee. The FTC wants him to study and report back on (1) whether uniform cost accounting is feasible, and, if so, (2) how may it be put into effect.

Basic reason for making such a study is the FTC's belief that uniform, industry-wide accounting systems would permit the government's antimonopoly lawyers to determine quickly and easily whether or not a firm is violating the Robinson-Patman Act or other pricing laws it is charged with enforcing.

Ripe for the Axe . . . Foreign-aid programs are headed for real trouble on Capitol Hill next year. There are two basic reasons why assistance funds are to be sharply curtailed — and in some cases wiped out.

First, members of both political parties are frankly disgusted at the failure of some Western European governments (France and Italy are prime examples) to come to grips with the Communist problem.

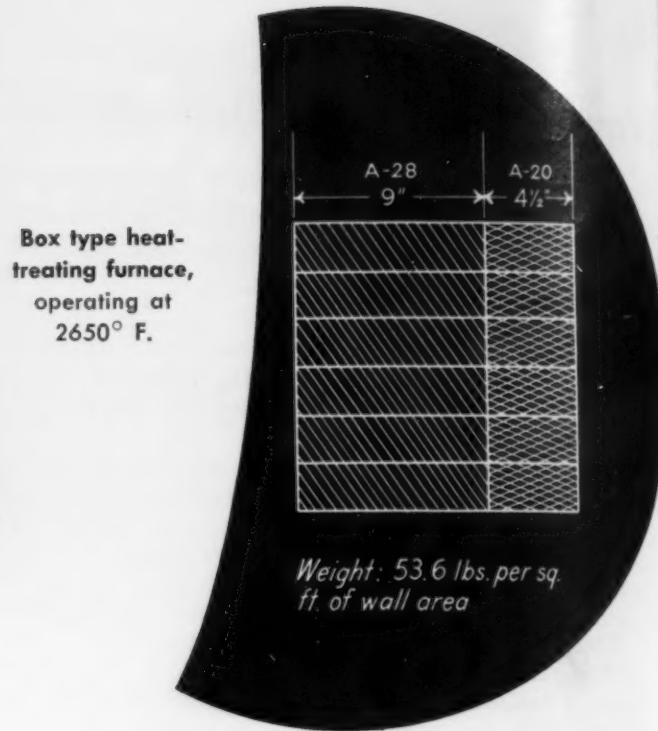
Secondly, it is believed that substantial budget savings may be affected by cutting spending for overseas relief, which in this fiscal year is costing U. S. taxpayers more than \$4.5 billions.

The Byrd Approach . . . When a Senate Democrat of Harry Byrd's stature states that U. S. aid to Europe can be cut by as much as 90 pct, Republicans and Democrats alike sit up and take notice.

Mr. Byrd is not a politician given to reckless statements. As a result, his views are highly regarded on both sides of the Capitol aisles. Byrd's approach to solving the problem of Europe's economic ills is simply this: (1) Give every encouragement to Western European nations to develop their foreign trade, (2) Shut off relief hand-outs.

Beer Can Economy

The Naval Supply Depot at Yokosuka, Japan, has come up with a novel disposition of empty beer cans. By selling them to the Japanese for salvage, the supply depot not only solved a disposal problem but returned more than \$7000 to Uncle Sam's coffers. The Japanese have a good use for them too. Enterprising merchants sell them back to souvenir-hunting GI's in the form of toys and cigarette lighters.



Which furnace construction has higher thermal efficiency?

These two furnace sections show how a simple change in wall construction can often result in greatly improved thermal efficiency and valuable fuel savings.

The first wall consists of 13½" of ordinary fire brick, backed up with 4½" of Armstrong's A-25 Insulating Fire Brick and 3¾" of common brick facing. Heat loss through this construction is 630 Btu's per square foot per hour, and heat storage amounts to 99,290 Btu's per square foot of wall area.

Now look at the improvement in these figures with the second design. Here, 9" of Armstrong's A-28 and 4½" of Armstrong's A-20 Insulating Fire Brick have been used. This more modern construction is far lighter, cuts wall weight from 198 lbs. to 53.6 lbs. per square foot. Heat loss is

cut to only 415 Btu's—a 34% reduction!

What's even more important, heat storage has been reduced by 74% . . . to 25,850 Btu's per square foot. With the furnace operating at 2650° F, this greater thermal efficiency is extremely important to conserve fuel and keep exterior temperatures at a reasonable level.

Do you have a furnace problem?

You'll find it's always a good idea to call in your Armstrong engineer whenever you have a furnace rebuilding or lining job. His sound knowledge of insulating fire brick and furnace construction will help you get top operating efficiency from your furnace. For his help, call your nearest Armstrong office or write Armstrong Cork Company, 2712 Susquehanna Street, Lancaster, Pennsylvania.



ARMSTRONG'S INSULATING REFRactories

Resources:

**Study U. S. future position...
Stress long-range planning.**

Construction of four or five types of atomic power plants, rather than the single facility authorized by Atomic Energy Commission, is the right way to learn which type is the best investment.

That viewpoint, expressed last week by a former AEC official and a university department head, was one of many topics discussed before delegates to the Mid-Century Conference on Resources for the Future. An estimated 1500 attended the Washington meeting to survey the natural wealth of the nation.

Dependency on Imports

Industrialists, educators, labor leaders, consultants on conservation, and government officials heard some of their fellow conferees argue for a strong program of direct government subsidies as a boost to the mining industry. Others offered a variety of proposals—tariff changes, exploration advances, production loans—to achieve the same purpose.

In separate working sections, the delegates appraised problems involving non-fuel minerals, land, water, energy, world supplies of materials, and research. They also held general sessions to hear prominent speakers discuss such questions as U. S. dependency on certain foreign resources.

Think in "Decades"

President Eisenhower, in a speech to the delegates, called attention to the long-range aspects of the problems on the agenda. These topics, he said, require thinking "in terms of decades, rather than in terms of months or the next election—or anything else that is temporary."

Early in the sessions officials of the Ford Foundation-backed group which set up the conference pointed out that they had made a strenuous effort to get delegates with opposing ideas on the various problems to insure that more than one viewpoint was expressed. This

statement appeared to be a denial of a charge by five organizations that the meeting would be stacked with men from industry opposing groups favoring public power development. These organizations withdrew their delegates.

Steel Mill:

State Dept. says "No" to Czech-Argentina mill deal.

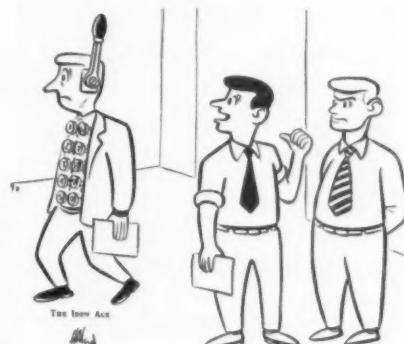
So far as the U. S. Government is concerned, the Czech-owned steel mill stored in this country isn't going anywhere until some American claims against the Red-run country are settled.

Underscoring this position was an official statement last week that for all practical purposes there is no contract permitting sale of the mill to Argentina. The Czechs, who owe money to Argentina, reportedly had made a deal to transfer ownership to the South American country for about \$13 million.

This move would have required no actual exchange of money. Thus it is unacceptable to the U. S., which insists the mill be paid for in dollars deposited here, where Czech use of the funds would be blocked.

Declaring existence of the Czech-Argentine agreement "null and void," the State Dept. has informed Argentina it will not recognize the contract.

Original cost of the mill, bought by Czechoslovakia in 1947 before the Communists seized the government, was \$18 million. Because no export license has been granted, components of the mill have been stored in Philadelphia, Troy, N. Y., New Castle, Pa., and Youngstown, Ohio.



"Jenson is invaluable. He's a walking adding machine!"

Titanium:

ODM expected to boost output goal to 35,000 tons or more.

Indications last week were that Office of Defense Mobilization will shortly set higher sights for the expansion of titanium production, probably to 35,000 tons or higher.

Current goal is 25,000 tons in 1956, revised upward in August from an earlier target. But military sources say they can't get enough, that even the proposed new goal won't be enough (See THE IRON AGE, Dec. 3, p. 244).

Titanium and rutile are currently on ODM's list III for additional tax amortization. In the case of titanium, other incentives such as price guarantees are also likely.

Sponge Facilities Shortest

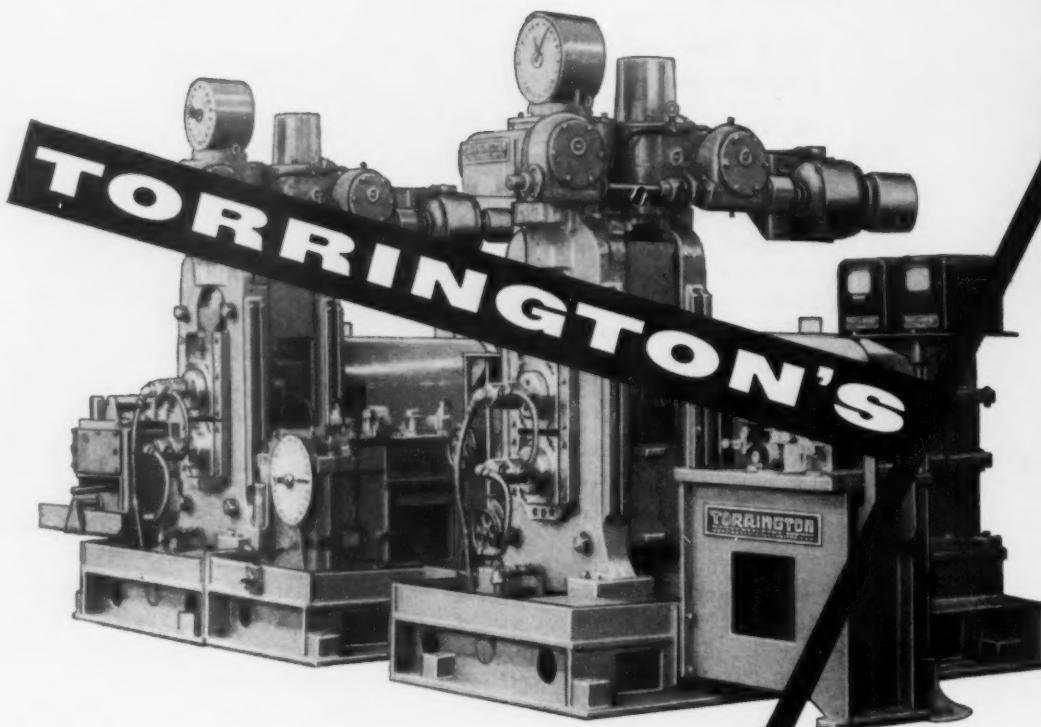
Reason is that chances of reaching the 1956 goal of 25,000 tons by the target date are dark at the moment. According to the latest report by ODM, only about 12,500 tons have been subscribed.

Biggest problem obviously is obtaining adequate supplies of titanium sponge. Melting and rolling capacity for the metal has kept ahead of sponge production and will stay that way.

Sponge is the first form, comparable roughly to pig iron relationship in making steel. In turn, sponge is manufactured from rutile or some other minerals such as ilmenite.

Further increase in domestic rutile production is sought although the available supply is in sight by counting on about 60 pct of the total from foreign sources. Tax writeoff certificates will be issued for new and approved projects.

A secondary problem now being threshed out is scrap recovery. Scrap is reported piling up in some instances and technical problems have been hampering recovery of titanium scrap from this source.



H I G H S P E E D F L A T W I R E M I L L S

These high-speed Torrington units are designed to roll flat wire at high production rates. Available in a wide variety of sizes with automatic controls, they provide maximum flexibility. Combinations of two or three flattening stands together with edgers accommodate a great variety of work. Handles 4,000 lbs. weight at entry, up to 1,000 lbs. on winder, with speeds as high as 3500 FPM and more. All operations can be performed by power—pneumatically, hydraulically or by electric motor—under operator's control at a main pulpit or at control stations advantageously located.

THE

TORRINGTON

M A N U F A C T U R I N G C O M P A N Y
T O R R I N G T O N, C O N N E C T I C U T

West Coast Report

Order Lull Boosts Mill Maintenance

West Coast steel mills take advantage of year-end slack to step up much-needed maintenance . . . Major firms schedule rebuilding . . . End Pacific States strike—By T. M. Rohan.

Long overdue need and a worse than usual year-end business lull brought about a step-up in maintenance and repair plans for western steel mills last week.

In Los Angeles, U. S. Steel's Columbia-Geneva Div. scheduled a complete openhearth shutdown for the last 2 weeks this month for installation of a larger charging box, strengthening of floors and allied changes.

In Seattle, Bethlehem-Pacific resumed operation of two of five openhearts this week after a complete shutdown last week. Rolling mills continued operation on accumulated inventory. A major overhaul of equipment there is also under discussion.

Pacific Strike Settled . . . In Niles, Calif., a 6-week strike at Pacific States Steel Co. was settled at week's end with 500 scheduled to resume work this week. Workers went out in "continuous meeting" after the firm attempted to lay off 72 workers in cutting back one furnace.

Some maintenance work and installation of control equipment was done during the idle period and some shipments made from stock. The firm's 12-in. mill was to start work on the ingot stockpile Monday and the 26-in. mill later in the week. Openhearth production will be resumed after furnaces are rebuilt.

Kaiser at Fontana scheduled a cutback on continuous operation from eight to seven out of nine openhearts. A production bottleneck on two of the rolling mills has caused some ingot inventory accumulation which will be worked down.

Both Kaiser and the U. S. Steel Pittsburgh Works were warehous-

ing tinplate as a result of the American and Continental Can Co. strikes which idled about 4000 workers in Northern California alone. Tinplate producers figured the strikes could continue another few weeks before production would have to be cut.

Big Heat . . . Biggest cross-section stress relieving furnace on the West Coast, a 20 x 20 x 32 ft unit, is nearing completion at Willamette Iron & Steel Co., Portland. Built to handle a 43-ft-long trunnion anchorage for The Dalles dam, the unit will operate up to 2100°F.

The trunnion anchorage will be treated by a double pass method through entrances at the two ends which can be bricked up around the 6-in.-diam piece. Other major units being put in by Willamette

are a planer to handle plate up to 40 ft long and 2 in. thick and an automatic boom welder for vessels up to 18 ft diam and 40 ft long.

Please Come Home . . . Western steel mills have for years drawn on midwestern and eastern talent to get facilities in operation. Last week the trend took a reversal when a Philadelphia mill advertised in a San Francisco newspaper for roll turners with structural experience.

Sagging western bar mill operations could easily result in a flood of applications.

Business Outlook Down . . . Manufacturing executives in California are not so optimistic over the near-term outlook for business as they have been.

This was revealed last week by the California Manufacturers Assn. in reporting a poll of member companies on first quarter 1954 outlook. Results indicate business and employment in California should remain at or close to the existing high level, but the manufacturers don't hold out much hope for gains in overall business activity. Dips below the business level of early 1953 are felt to be in prospect for many lines during early 1954.

Forty pct of the executives said they expected their own company to book orders in the first quarter of 1954 in the same amount as in the first 3 months this year. But almost the same number (38 pct) expect a smaller volume of orders and only 22 pct expect an increase. This is the smallest number of manufacturers to predict a larger volume since CMA started making its quarterly polls more than 4 years ago.

Factory employment in California in the third quarter averaged 71,700 more than in the same period last year. This is the smallest year-to-year workforce gain since the second quarter of 1950.



NEWLY-ELECTED president of National Assn. of Manufacturers for 1954, Harold C. McClellan, president of Old Colony Paint & Chemical Co., Los Angeles, is first Pacific businessman to head NAM.

Load, engage feed and unload — that's all there is to it with this **CH** miller!



HERE ARE THE JOB FACTS

Co.: Aeroaffiliates, Inc., Fort Worth, Texas

Machine: 10 hp, No. 3 Model CH Vertical Milling Machine

Depth of cut: 2 inches

Feed rate: 6 1/2 ipm

Cutter: 4-lip HSS 1 1/4 inch end mill

KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS



CH Milling Machine features that helped increase output — cut cost per piece



Greater Cutting Efficiency through spindle mounted flywheel, (optional), running with three bearing support.



Greater operating convenience through Mono-Lever control (optional) for table feed and rapid traverse.



Smoother Feed Performance through large dia. heavy-duty table feed screw that affords greater bearing contact. All models are equipped with a back-lash eliminator.

Aeroaffiliates of Texas select Kearney & Trecker 10 hp No. 3 Model CH Vertical Milling Machine with Mono-Lever and Automatic Cycle Table Control, to speed milling of aircraft parts and reduce operator fatigue!

TO finish-mill aluminum vertical beam fittings, this manufacturer put production on an almost automatic basis without sacrificing accuracy. He's handling the job on a 10 hp, No. 3 CH Vertical Milling Machine equipped with Mono-Lever and Automatic Cycle Table Control.

Now, after the original setup, all the operator does is load the machine, engage the feed and unload. Production is up, accuracy is maintained and operating conditions have been greatly improved due to the reduction in operator fatigue.

Check this great CH line of machines for yourself. See how you, too, can cut costs, increase productivity, improve safety, get better finished products. Contact our representative or write Kearney & Trecker Corp., 6784 West National Avenue, Milwaukee 14, Wisconsin.

Machine Tool High Spots

Tailored Loans Ease Tool Buying

Term loans help buyers get new machinery . . . Equipment pays for itself from increased earnings . . . Capital is left free . . . Writeoffs for machine shops—By E. J. Egan, Jr.

Hit or miss methods of deciding when to replace obsolete machine tools are gradually being superseded by modified versions of the purchase-timing formula developed by the Machinery and Allied Products Institute. (THE IRON AGE, Nov. 12, 1953, p. 139.)

But in addition to knowing when to buy new equipment, companies must also know how to make these purchases without impairing their working capital.

Industrial financing organizations, quick to spot the merits of practical machinery replacement programs, are offering their services to firms with funding problems.

Tailored Loans . . . Term-loans, which leave working capital free for current expenses while permitting new equipment to pay for itself out of increased earnings are advocated by S. D. Maddock, president of C.I.T. Corp., industrial loan firm. These loans can usually be tailored to the borrower's income and needs.

Two other sources of credit are generally available to industry. First of these is the short-term bank loan, usually a working capital loan for a short period. Second source is limited credit from machinery and equipment makers, often not sufficient to swing major replacement programs.

For Expanded Capacity . . . Also influencing the financing of many machine tool purchases or replacements is the tax writeoff period allowed by the government. Under terms of the Defense Production Act, many larger firms buying tools and expanding pro-

duction capacity were allowed to writeoff all or part of their expenditures in 5 years instead of the customary 20-year period.

Under this plan, small machine shops doing work for the defense program as subcontractors, or in many cases as prime contractors, were denied these tax amortization benefits. Many of these concerns had their applications turned down because they were classed simply as "machine shops" and the Administration held there was no machine shop shortage.

Refer to SBA . . . But since it has become apparent that many of these applications from small

firms have been meritorious, and will continue to be so until defense production goals are attained, ODM will henceforth refer all small shop requests for fast tax writeoffs to Small Business Administration for study and advice. This work will be directed by L. P. Fairlamb, of the SBA Office of Production and Distribution Assistance.

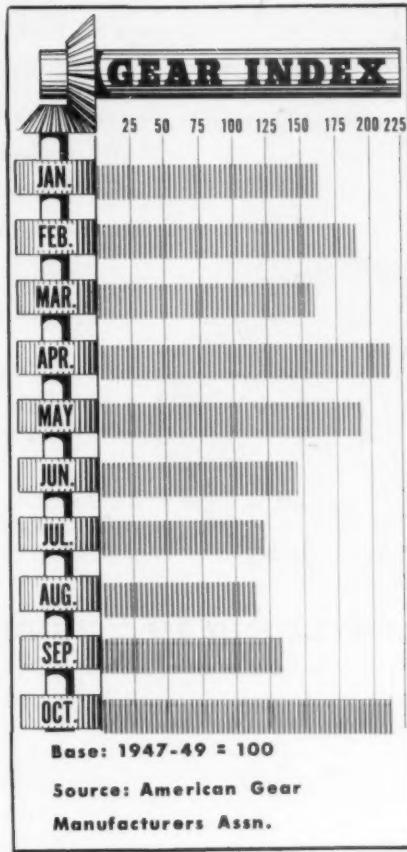
Small shop amortization requests requiring field investigation will be referred to SBA regional offices. Staff members of these offices will confer with shop operators in order to confirm and evaluate information contained in their applications to ODM. Reports on these firms will be forwarded to Washington as a basis for proper judgment by SBA and ODM officials there.

Stop Tax Write-offs . . . In other government action last week, Office of Defense Mobilization stopped fast tax writeoff grants for many types of industrial expansion (see p. 87). Of particular interest to machine tool builders, ODM suspended issuance of tax certificates for 49 items on List II pending determination of need for additional expansion.

Included in List II are machine tools, metal cutting tools and related equipment.

Gets Large Grinder . . . One of the largest surface grinders ever built has recently been installed by the Monarch Machine Tool Co., Sidney, Ohio, for the precision grinding of lathe bed ways up to 32 ft long, and to a tolerance of 0.0005 in. throughout the entire length of the way.

Built by the Thompson Grinder Co., Springfield, Ohio, the new machine is 79 ft long, 13 ft high and 13½ ft wide. It is equipped with four 30 hp motors and one 40 hp motor driving two grinding wheels which can be operated simultaneously.



Introducing . . .

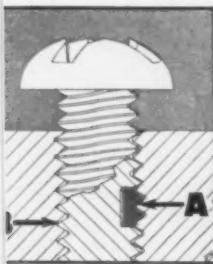
HOLTITE NYLOK

Reg.

ONE-PIECE SELF LOCKING SCREWS AND BOLTS



HERE'S WHY
HOLTITE-NYLOK
LOCKS SECURELY



HOW NYLOK LOCKS (Patented)

Resilient Nylon plug (A) sets up lateral thrust, smoothly wedging mating threads together (B). All of locking action is on the threads; head is not stressed. Locking is positive seated or unseated.

... SAVES YOU TIME AND MONEY!

Eliminates safety wire, lock washers, jam nuts, and all other locking devices.

The new Holtite-Nylok screws and bolts employ a nylon insert in the threaded section that provides a smooth, positive locking action. Seated or unseated, they lock where stopped.

... PLUS THESE EXTRA ADVANTAGES

- Positive Locking
- One piece; eliminates separate auxiliary parts
- Readily replaced
- Interchangeable
- Re-useable
- Locks seated or unseated
- Defies vibration
- No harm to mating thread of parts
- Acts as a seal for gases and liquids under high pressures

YOU CAN ALWAYS COUNT ON CONTINENTAL'S ENGINEERING SERVICE

As Holtite-NYLOK fasteners are presently intended for specific applications, our engineers welcome the opportunity to study your individual requirements and make recommendations for the most efficient and economical applications.

Why not check your own assemblies today. There's a good chance Holtite-NYLOK can boost your output, and save you money.

CONTINENTAL SCREW COMPANY

NEW BEDFORD, MASSACHUSETTS, U. S. A.

Planning

REPORT TO MANAGEMENT ..

Press for
the impossible

There's something ominous in the way steel and auto unions publicly pledge themselves to press for the guaranteed annual wage. In previous years, unions traded this item off with familiar alacrity at the bargaining table. But current firm statements by union leaders are bound to be interpreted as promises by their rank and file. With this may come the obligation to win some guaranteed annual wage concession. In the manner of the camel intruding its head into the tent, unions may be willing to accept any sort of deal this year and rely on future strikes and bargaining to fortify it.

FRB index
dips a little

Plus and minus factors of business indicators continue to add up to overly high inventory for durable goods industries and expanded plants capable of oversupplying the market. Further durable goods cutbacks helped nudge Federal Reserve Board's November preliminary output index slightly down to 228 pct. This was 3 points under October and 6 points below November '52. Iron Age estimates the FRB index for fourth quarter '53 will average about 230 against 233 for last year. Reaching a summit of 243 last March, the index since then has downtrended. It soon may stabilize, then fluctuate normally in both directions.

Shrinkage
of backlogs

Just topping '52 by \$100 million, October manufacturing sales at \$26.6 billion were after seasonal adjustment \$100 million under September. Flourishing sales combined with a lesser rate of new orders further shrank unfilled order backlogs, put them at \$61.4 billion or about \$13 billion below '52. Plentiful supply of materials has decisively curbed long-term ordering and returned backlog levels nearer to normal market status. Meantime, industry's intent to align inventory to realities of actual demand was reflected in inventory cuts of \$200 million in October.

Installment
buying orderly

Any fears that a runaway consumer installment debt was stampeding us into trouble can be officially squelched. (This page has long maintained that the size of installment debt was in no way hazardous.) Stacked against a \$521 million climb a year ago, October 1953's \$139 million rise in installment debt indicates this buying is approaching a more normal pace. Total debt as of October: \$21.5 billion--or \$3.9 billion over 1952.

Peak month
for construction

Construction continues to thrive, will be a solid girder for 1954 prosperity. Shipments of fabricated structural steel in October were 289,755 tons, highest tonnage since October 1929. Though October construction bookings dropped 12 pct from September, they still stood 4 pct above last year.

Perk up
housing trend?

Steps are being considered to reverse the gentle but persistent skid of private housing starts. While mortgage money has eased considerably in recent months, mortgage terms remain relatively strict. In October, 88,000 housing units were started against 89,000 in September and 99,000 a year ago. To furnish a tonic to home building, plans are reportedly under Washington scrutiny to ease down payment, terms of FHA mortgages. As this page stressed a few months ago, homebuilding's downtrail could, if unchecked, adversely influence '54 prosperity.

Fewer planes
in 1954

If you're an aircraft supplier take a hint from a statement by Admiral D. C. Ramsey that output of military planes is headed gradually down from its 1953 high point of \$8 billion in sales. In the auto industry December output may register a 23 pct gain from a low November rate. September sales of used cars slipped 13 pct. Electrical energy output for the week ended Nov. 28 was 5.7 pct over '52. Almost unaccountably, department store sales which had rallied after an October dip faltered again.

A *miracle* of Annealing Efficiency

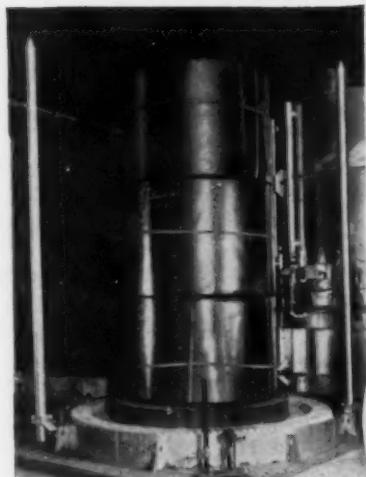


Here's the fastest, most accurate annealing system yet developed . . . with a plus feature that eliminates down time due to repair and maintenance. Truly a miracle of annealing efficiency. That's the Lee Wilson Single-Stack Portable Base Radiant Tube Annealing System, the latest innovation by the company that invented and developed radiant tube annealing.

A Lee Wilson engineer can prove to you that by using single-stack type furnaces you are able to double production from a given floor area, and with lighter, less expensive auxiliary equipment. The new, doubly efficient, high speed Wilson "O" tube not only steps up production speeds but permits a much greater accuracy of heat control. This means you get faster production of a better product.

And the completely portable base can, when maintenance is required, be detached in a matter of minutes, removed by light crane equipment . . . a spare base dropped in place, and production continued.

There's a lot more . . . for example, expensive basements and understructures have all but been eliminated. But why not get the full story? Write today for a copy of Lee Wilson's Single-Stack Portable Base brochure.



A typical load on a single stack furnace base . . . 72" in diameter . . . a piling height of 20' . . . each coil weighing 20,000 lbs.

The heart of the Lee Single-Stack Furnace is the drive Type Radiant Tube arrangement that delivers an increased 500,000 BTU per tube, per hour.

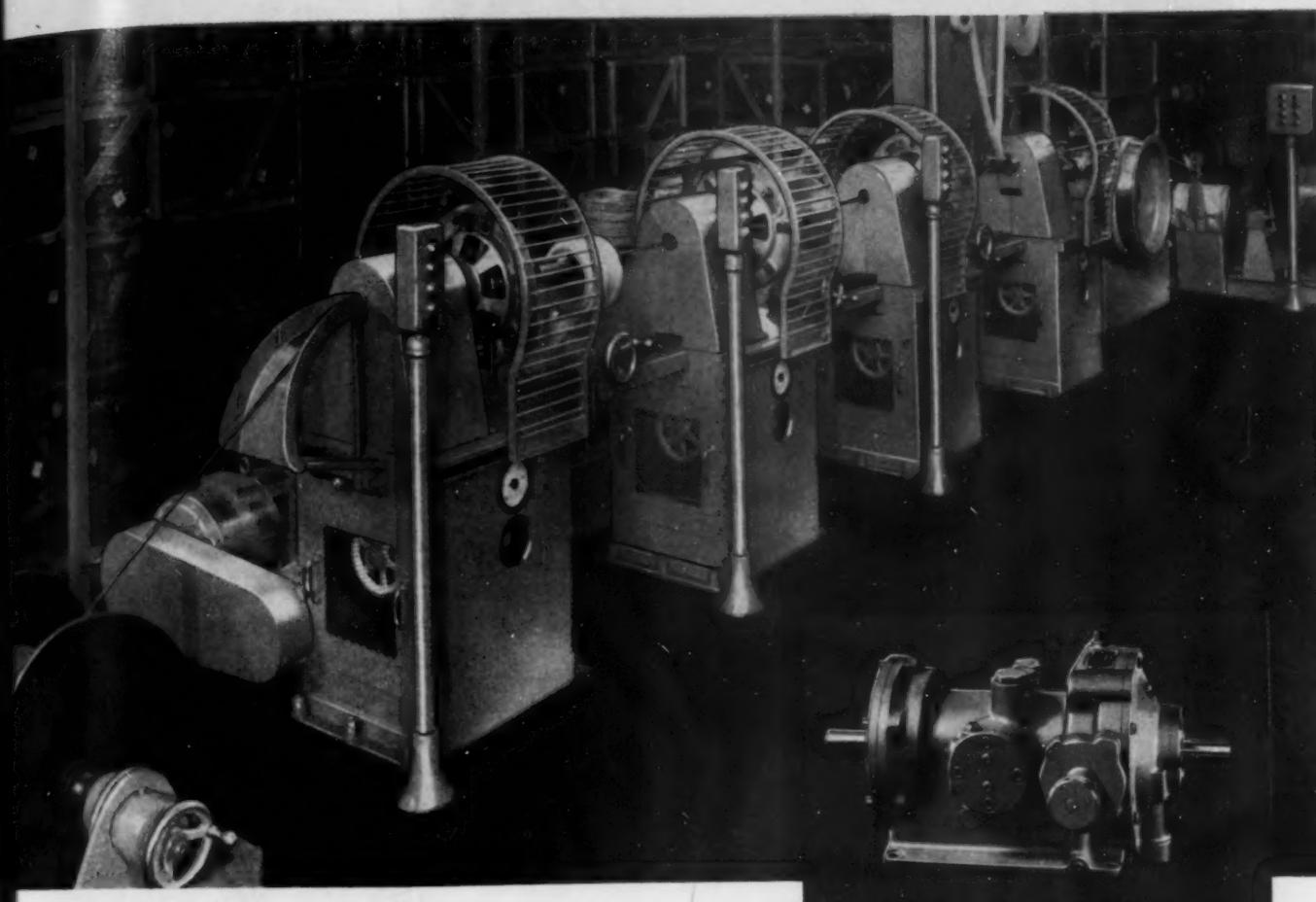


Lee Wilson

ENGINEERING COMPANY • IN

20005 WEST LAKE ROAD • CLEVELAND, OHIO

MACHINE DESIGN AT WESTERN ELECTRIC



Its use of Oilgear Fluid Power

Western Electric Company, manufacturing unit of the Bell Telephone System, originates, designs and builds many of the special machines it uses in its own manufacturing processes. It also maintains unceasing pressure to improve upon machines already in operation, for optimum performance, for better product, for lower costs, for freedom from trouble.

Its use of Oilgear Fluid Power Drives and Transmissions has been increasing because, in the words of their engineers, Oilgear enables them among other things to synchronize many machine components easily and economically. A good example of all these points is the "short haul" video cable wrapping machine pictured above.

This machine was designed and built by the company's own men some years ago. For optimum

performance, the speed of the heads should be easily and independently variable and the direction of rotation instantly changeable because the lay and pitch of the wrappings must be varied according to the requirements of the run. Moreover, the inside contour of the tube formed by the wrapping should be smooth and uniform so as to avoid setting up echo waves that interfere with transmission and vitiate signal strength.

Because of these requirements, a new drive was installed something over 4 years ago. A line shaft drives five Oilgear Fluid Power Transmissions, one at each machine head and the capstan.

The results were these: uniformity and control of tension are so good, the machine runs at 4 times its former machine speed; it is easy to vary speed and direction of rotation of each individual head; eccentric heads gave way to concentric heads, and supply spools are now loaded to full capacity instead of $\frac{1}{4}$ th to $\frac{1}{8}$ th as before; the machine is stopped less frequently for loading. Maintenance on the former drive was involved and frequent—on the Oilgear equipment it has been simple and negligible.

There is some reason to suspect that Oilgear Fluid Power with its wide range of advantages may solve some of your machine design prob-

lems and make the results very pleasing and profitable. Why don't you really find out? THE OILGEAR COMPANY, 1581 West Pierce Street, Milwaukee 4, Wisconsin.





Photo courtesy Monarch Rubber Company

STOPS SHIPPING DAMAGE; CUTS COSTS 46% with Brainard Strapping Service

WHAT would you do if shipments of your products continually arrived broken and damaged? This manufacturer of industrial tires called in the nearest Brainard Strapping System salesman, Rudy Schulz of Wooster, Ohio, for his ideas.

After following this shipping problem right into the boxcar, Rudy came up with specific recommendations, followed by a demonstration *on the job*. The old method of wood blocking was dropped. Now the pallets of tires are loaded tightly together and steel strapped to walls and to a special bulkhead designed around the pallets.

Results—damage in shipment and costly claims have been completely eliminated. A source of customer dissatisfaction has been removed. Yet this improved shipping method actually has cut costs 46% per boxcar shipment.

Brainard salesmen are factory trained to give you recommendations and demonstrations that can improve the efficiency of your materials handling and shipping operations. Put Brainard's experience to work for you now. Offices located throughout the U. S.



New Portable Strapping Kit—the Brainard Utilikit is a completely self-contained strapping outfit. Easily carried from job to job. Ideal for the small volume user. Write for booklet.

Write for complete information. Brainard Steel Division, Sharon Steel Corp., Dept O-12, Griswold Street, Warren, Ohio.

STEEL STRAPPING



Free Publications

Continued

Graph plotting

Unusual method for automatic creation of performance and value pictures in graph form from punched cards is described in free booklet, "IBM Automatic Graph Plotting." These graphic charts, used extensively in business and industry for analyzing trends as well as for rapid evaluation of performance figures and values, include line graphs, point graphs and bar graphs. Booklet describes how wheel printing feature of IBM type 407 accounting machine is utilized to plot graphs from information punched on IBM cards. *International Business Machines Corp.*

For free copy circle No. 13 on postcard, p. 109.

Hydraulic valves

Details and specifications of the V10 series miniature hydraulic valve are found in bulletin recently released by Skinner Electric Valve Div. The V10-1000 is a spring-loaded, direct-acting slide-type valve. Stainless steel internal parts assure long service. Precision-honed bore in valve body, and centerless-ground, heat-treated plunger guarantee a controlled leakage factor. *Skinner Electric Valve Div., Skinner Chuck Co.*

For free copy circle No. 14 on postcard, p. 109.

Reamers

Statistics and details on Pratt & Whitney Blue Helix reamers are given in new brochure. The extremely fine grinding finish on the chamfer and lands of Blue Helix reamers greatly reduce initial wear. Contact on the concentric margin is distributed over smooth bearing area and results in added wear life on the important O.D. dimension of reamer. *Pratt & Whitney.*

For free copy circle No. 15 on postcard, p. 109.

Service station plan

Recent bulletin describes new G-E motor service plan for fractional and integral hp motors and generators. Booklet explains types of service provided, service warranties, motors covered by plan and fhp motor factory repair service. *General Electric.*

For free copy circle No. 16 on postcard, p. 109.



THE BURLINGTON LIARS' CLUB
SPINS A YARN FOR BAKER'S MAGDOLITE



BUILT-A BETTER MOUSETRAP

Tabby lived and hunted in a mill overrun with mice. Apparently, however, the mice were very smart because Tabby never caught any. Then, one day, he accidentally lost a front paw in the machinery. Feeling sorry for Tabby, one of the workers whittled him a peg-leg. Soon, he began to bring in mice by the dozens!

Investigating, the worker found that Tabby hid behind a post in the store room. From trying to look around both sides of the post at the same time, he had become crosseyed, a circumstance which threw the mice off guard. When they thought—by watching Tabby's eyes—that he was looking elsewhere, they would venture out of their holes. Still watching his eyes, they would come closer and closer until they were within his reach. And then Tabby would

let go a haymaker with his wooden leg and club them to death!

The J. E. Baker Company didn't build a better mousetrap, but it did discover, years ago, how to make a better dolomite. Through continued research, BAKER'S MAGDOLITE, the original dead-burned dolomite, was developed. Constantly improved through the years, BAKER'S MAGDOLITE, with its superior chemical, physical, mineralogical composition and its properly burned grain-size particles, delivers more uniform ingots with less defective production material.

Try BAKER'S MAGDOLITE today! See for yourself why it's always 5 ways better: Composition, Preparation, Strength, Economy, Quality.



PRODUCTS
SINCE 1889

MAKERS OF BAKER'S
MAGDOLITE

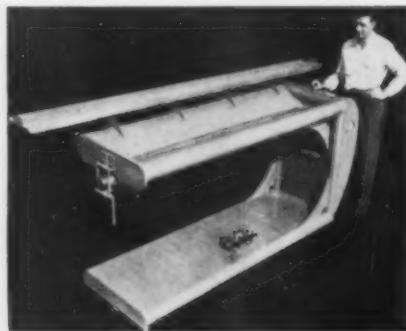
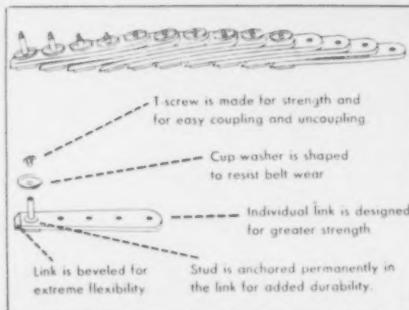
THE J. E. BAKER COMPANY
YORK, PENNSYLVANIA

Plants: York, Billmeyer, Pennsylvania—Millersville, Ohio

© The J. E. Baker Company

NEW EQUIPMENT

New and improved production ideas, equipment, services and methods described here offer production economies . . . just fill in and mail the postcard on page 109 or 110.



Adjustable V belt for D and E drives

The new TD and TE Veebos V belt for D and E drives is adjustable and said to be the easiest possible V belt to couple and uncouple. These link belts are made of plies of especially treated high-tensile strength canvas duck, joined by riveted studs with removable cup-washers and T screws. This con-

struction is said to give greater strength and durability at all key points. Maximum flexibility provides long service life and full power delivery. Two types are available: regular rubber coated for general services and oil-proof for oily and high temperature drives.

Manheim Mfg. & Belting Co.

For more data circle No. 17 on postcard, p. 109.

Permits mounting any automatic welding process

New longitudinal fixture with numerous individual fingers holds and aligns any metal of almost any thickness in almost any shape. It permits mounting any of the automatic welding processes as well as making hand welding possible. At all times during the automatic welding operation, the results are

visible to the operator. The rotating mandrel accommodates several copper back-up bars, any one of which can be rotated into position with little effort. Metal thickness from 0.005 to 1 in. may be welded without a major change.

Airline Welding & Engineering.

For more data circle No. 18 on postcard, p. 109.

New boomstop prevents crane boom accidents

The Rud-o-Matic Thomas boomstop prevents boom kinking and twisting, stopping accidents before they start, by automatically cutting off power the moment the boom is raised too high. The entire operation is automatic; no adjustments are necessary, nothing has to be turned on or off. Crane is protected from the moment the engine is started until the work is completed.

Two boomstop models are for small cranes up to 20 ton capacity and for cranes from 20 to 100 ton capacity, respectively. Dual spring-loaded rams, mounted on the A frame or gantry of the crane, provide a soft, cushioning effect, and arrest boom movement when a load cuts loose and boom whips back.

McCaffrey-Ruddock Tagline Corp.

For more data circle No. 19 on postcard, p. 109.

Diesel engine driven welder has 300-amp capacity

Multi-range arc welder especially designed for locations where electric power is not available and a minimum operating cost is desired, is powered by a General Motors Model GM-2055, 2 cycle unit injection diesel engine, that features oil cooling, displacement blower, fuel filtration and easy starting. The engine has a piston displacement of

141.8 cu in. and is rated at 67 hp at 1500 rpm. Equipped with Multi-Range dual control and exclusive remote control, the welder permits the operator to make fine voltage-ampere adjustments right at the work, selecting the right arc intensity to suit job.

Hobart Bros. Co.

For more data circle No. 20 on postcard, p. 109.

Turn Page

Efficiently serving one of America's largest producers of

STAINLESS WIRE



V

A U G H N [®]

WIRE DRAWING MACHINERY

Many types of Vaughn Wire Drawing Machines serve ALLEGHENY LUDLUM STEEL CORPORATION in the stainless Wire department at Dunkirk, N.Y. In this exacting assignment, the outstanding Vaughn qualities of speed, endurance, versatility shine as bright as the product—year in and year out!

THE VAUGHN MACHINERY COMPANY

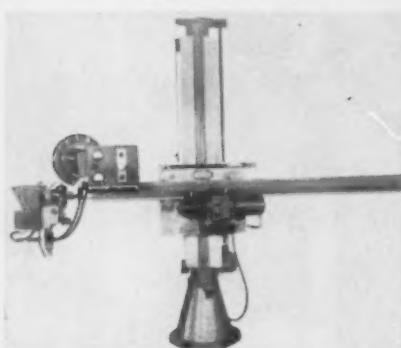
CUYAHOGA FALLS, OHIO, U. S. A.

COMPLETE COLD DRAWING EQUIPMENT—Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

"Quick on the Draw!"

New Equipment

Continued

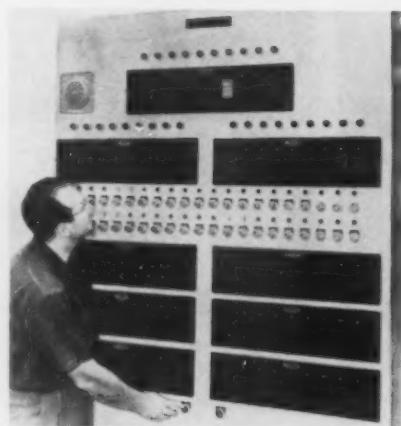


Flexible fixture produces fast, low cost welding

A ram type machine featuring ruggedness, precision and versatility is said to produce faster, better and lower cost automatic welding. The tubular lateral ram, with automatic head attached, travels 6 1/2 ft over the positioned or rotating work. Variable speed drive provides welding speed range of 0 to 100 ipm. Motorized vertical adjustment ranges

from 13 in. to 6 ft. The tubular column containing counterweight, and the ram rotate 360°. The head mounts easily on the ram. The CB 6x6 may be mounted on a carriage to travel longitudinally on special track. Any length track may be used; comes in 10-ft lengths. C. B. Herrick Mfg. Corp.

For more data circle No. 21 on postcard, p. 109.



Sequence annunciator analyzes shut-down causes

A new visual annunciator system which automatically indicates the sequence of off-normal alarms, is used where alarms are applied to closely inter-related variables. In most of such applications, if any one of the variables goes off-normal, the process shuts down. Sequence indicating annunciators pinpoint the cause of trouble by indicating the first variable to go off-normal. This is accomplished either by au-

tomatic lock-out of subsequent signals, or by causing the first signal to be red and subsequent signals white. Pushbutton reset feature is available. The alarm signals are grouped for sequential lock-out by simple jumper connections on the rear terminal block, and any number of inter-related groups may be formed or interchanged as desired. Panalarm Products, Inc.

For more data circle No. 22 on postcard, p. 109.

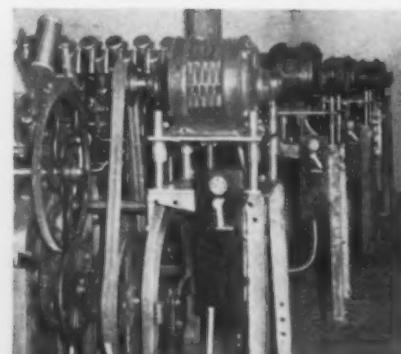


Constant voltage welder for automatic welding

Designed for powering submerged arc, inert gas and other types of automatic welding processes, a new rectifier-type dc welder is rated at 1000 amp continuous duty, with infinitely variable pre-set arc voltage range of 18 to 42 v. It operates on 3 phase, 60 cycle ac power, 240 or 480 v. Efficiency is said to be 85 pct or better and power factor 90 pct. Because arc voltage can be pre-set at the machine and remains constant during weld-

ing, no external voltage controls are required. Rate of deposit is regulated by rate of rod feed. Speed regulation of the rod feed roll motor is the only external control used. Uniformity of arc voltage is said to eliminate bad welds due to poor fit-up, to reduce faulty welds, and to increase production. Automatic stud welding and compressed air-carbon arc cutting and gouging operations are also possible. Glenn Co.

For more data circle No. 23 on postcard, p. 109.



Motor base has vertical adjustment

Six-inch vertical adjustment is provided by the LMV motor base. Besides saving floor and machine space, it provides the great amount of adjustment required where driving wheels that operate with endless belts or chains, are changed. The vertical motion is also great enough for use with the spring loaded type of variable speed motor

pulley. The base is all steel fabricated construction. Base shown accommodates electric motor frame 284—7 1/2 hp at 1800 rpm, 5 hp at 1200 rpm, or 3 hp at 900 rpm. Center adjusting screws can be shortened where full 6 in. movement is not required. Quintin Kearney.

For more data circle No. 24 on postcard, p. 109.

Turn Page

BIG MANIPULATOR

Alliance MANIPULATOR INCREASES PRODUCTION FROM 200 TO 400%

This 75-ton Alliance Manipulator is the world's biggest. It handles ingots for ship shaftings . . . press columns, large naval gun barrels and other huge jobs.

At the International Nickel Company plant in Huntington, West Virginia, two 4-ton straight line Alliance Manipulators serve a single hammer . . . forging Monel metal ingots from 14" x 14" down to 8" x 8". They helped boost 8 hours' production to 250% of the former record capacity with less than half the number of men.

Alliance builds forging manipulators in capacities from 1 to 75 tons in the following types . . . straight line trolley only, straight line trolley with bridge, sluing trolley type, sluing trolley type with bridge and crane type. Some bridge type manipulators handle the entire job—charging, forging, discharging and delivering.

Users of Alliance Machine Company Manipulators report 200 to 400% increased production with a smaller crew.

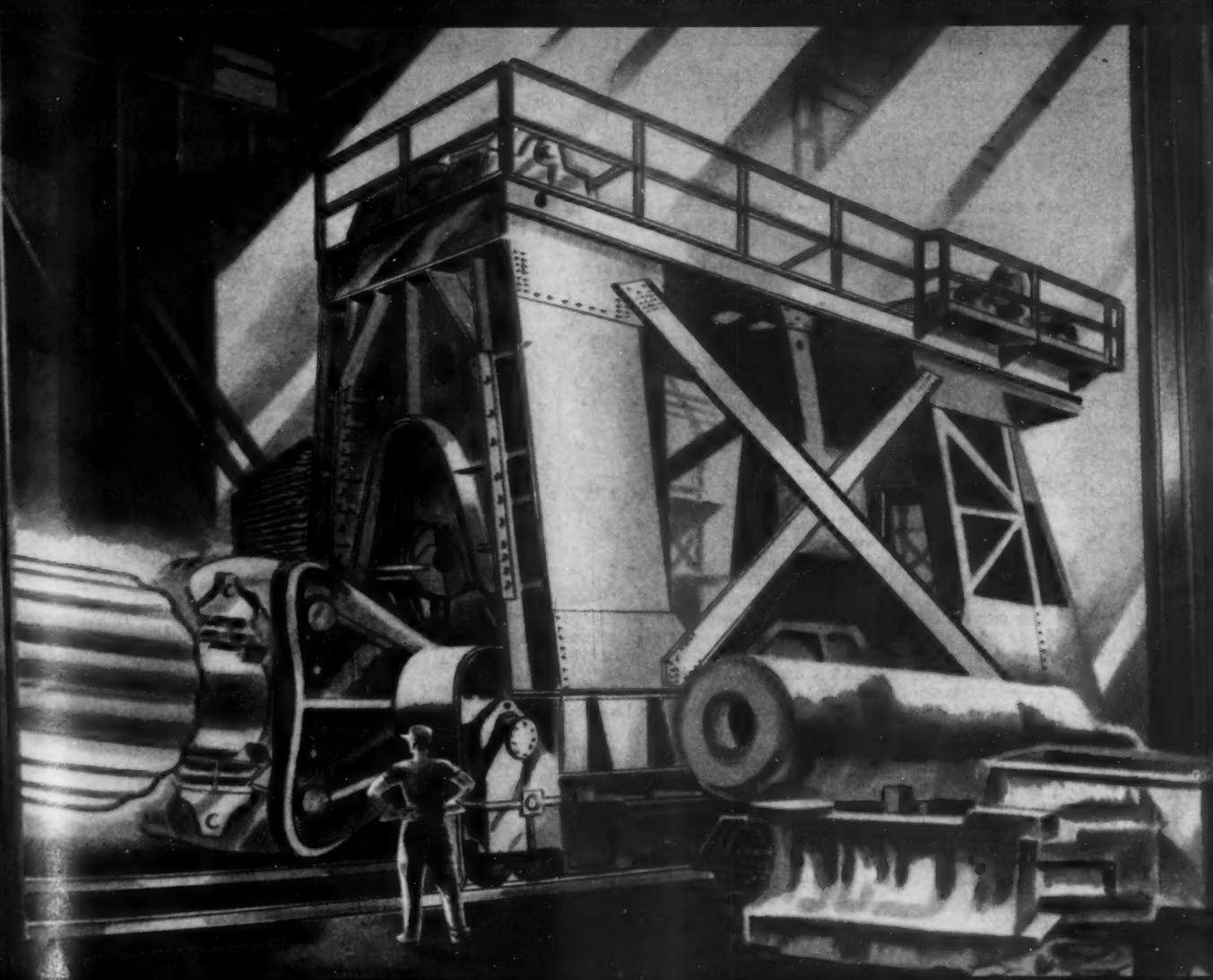
If you are not using Alliance Manipulators now, you can increase production and save money by writing us today.

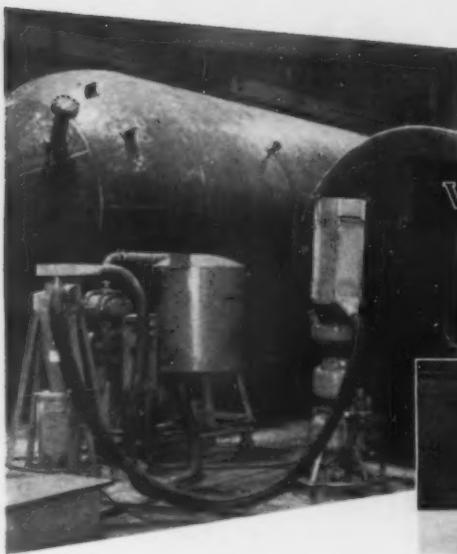
THE *Alliance* MACHINE COMPANY

Main Office: Alliance, Ohio

LADLE CRANES · GANTRY CRANES · FORGING MANIPULATORS · SOAKING PIT CRANES
STRIPPER CRANES · SLAB AND BILLET CHARGING MACHINES · OPEN HEARTH CHARGING
MACHINES · SPECIAL MILL MACHINERY · STRUCTURAL FABRICATION · COKE PUSHERS

Give Us The Runway And We'll Lift The World





NEW DUST COLLECTOR UNIT gives

VACU-BLASTER

**100% faster
cleaning rate**



Greater abrasive output with 100% increase in blast cleaning speed can now be obtained from Vacu-Blaster units equipped with the new D-6 Dust Collector Unit. This new unit permits use of higher capacity blowers with a corresponding increase in the size of blast nozzles. The higher pickup rate thus achieved means that nozzles up to 7/16" may be used to deliver as much as 100% more abrasive than formerly possible with smaller nozzle sizes. Where even greater pickup capacities are required, two D-6 Dust Collector Units may be used in parallel with a connecting wye.

THESE D-6 FEATURES

Assure Improved Dust Collector Operation

- Improved design — new tubular bag design facilitates better, more thorough bag shaking, gives better accessibility for bag inspection and replacement.
- Increased bag area — total cloth area of 186 square feet, approximately 3½ times that of previous models.
- Better dust collection — greater bag area means less air filtered per square foot of cloth, results in better filtering action, longer bag life, less clogging.
- Weatherproof construction — electrical components enclosed in weatherproof switch box, exposed wiring encased in protective sheathing; entire unit may be left outside if necessary.

ONLY VACU-BLASTER

Offers Dust Free Blast Cleaning

By combining blast cleaning with a unique vacuum pickup, Vacu-Blaster eliminates costly cleanup time and permits blasting operations anywhere in your plant. The nozzle releases an intense stream of air and abrasive through the center cone of the gun. Used abrasive and debris are picked up by the vacuum return.

A surrounding brush admits air, preventing the escape of any dust or grit. Spent abrasive and debris are carried off to a reclaimer unit which separates and reuses the cleaned abrasive; dust is filtered by a dust collector unit which releases only clean air. The entire machine is portable for use where needed. Contact your local VACU-BLAST Representative, or for further information write to



VACU-BLAST CO. INC.

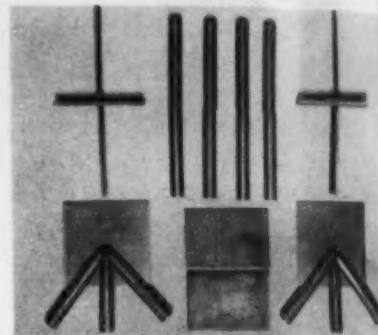
P. O. BOX 285-H, BELMONT, CALIFORNIA

New Equipment

Continued

Welders' test kit

Conforming to Air, Navy, Ordnance Specifications Mil-T-5021, new welders' test kit saves time and money since everything necessary for Government certification of

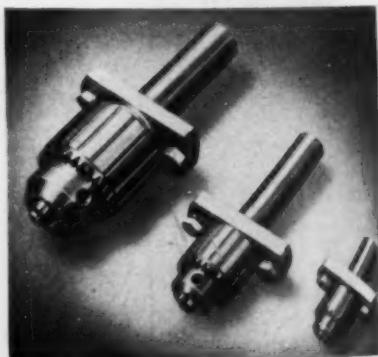


welders is included. The kit consists of 2 clusters, 1 plate, 2 crosses, 2 sets of tubes; all are made of chrome molybdenum. Also included are all the necessary application forms. *CBC Welding Corp.*

For more data circle No. 25 on postcard, p. 103.

Floating holders

Perfect alignment of drills, reamers, counter bores and similar tools is quickly accomplished with chuck-type floating holders. Holders are made in two parts: the shank which has an integral flange, and a similar flange on which the chuck is



mounted. The two parts are fastened together by two cap screws, threaded into the shank flange. Screw holes in the chuck flange are larger in diameter than the screws, permitting the chuck-hold cutting tool to be brought into perfect alignment with the work. *Barnaby Mfg. Co.*

For more data circle No. 26 on postcard, p. 103.

Turn Page

NEW PROTECTIVE COATING CHEMICAL FOR ALUMINUM

ALODIZING

Alodizing with "Alodine,"* a new technique in the protective coating of aluminum, was made available for production-scale use in 1946. Since that time Alodizing has largely supplanted the more elaborate, costly and time-consuming anodic treatments in the aircraft and other industries.

Continuous and successful industrial use has clearly demonstrated the simplicity and economy of the Alodizing process as well as the effectiveness of the "Alodine" amorphous coatings, particularly as a base for paint. In fact, the paint-bond that Alodized aluminum provides has been found to be superior to that possible with chromic acid anodizing.

The corrosion-resistance of unpainted aluminum Alodized with "Alodine" Nos. 100 or 300 is excellent, easily meeting the requirements of Specification MIL-C-5541. However, a need for protection of unpainted aluminum, even better than that obtained with chromic acid anodizing, has long been recognized.

NEW IMPROVED "ALODINE" DEVELOPED By ACP RESEARCH CHEMISTS

Several years of intensive research have now led to a new type of "Alodine," designated as "Alodine" No. 1200. This new protective coating chemical forms an amorphous mixed metallic oxide coating of low dielectric resistance that provides unusually high corrosion-resistance for unpainted aluminum. In addition, it forms an excellent paint bond that approaches closely the high quality obtained with the earlier types of "Alodine."

After having been tested for conformance with Specification MIL-C-5541, "Alodine" No. 1200 is now about to go into production.

PROCESS DETAILS

"Alodine" No. 1200 is the only essential chemical needed to prepare the coating bath and the final rinse bath. One of its unique features is that it can be used in tanks in an immersion process, or, in a multi-stage power washer in a spray process, or, with a slight adjustment of pH, with brush or portable spray equipment in a manual process. This means that even where the simple production equipment is not available, or where touching up of damaged coatings previously Alodized or anodized is required, excellent protection and paint bonding can still be obtained with practically no equipment.

**Alodine* Trade Mark
Reg. U. S. Pat. Off.

All three methods of application easily meet the requirements of Specification MIL-C-5541.

Process sequence for all three methods of application is the same as for other standard grades of "Alodine" such as Nos. 100, 300, and 600, viz.: 1. Pre-cleaning. 2. Rinsing. 3. Alodizing. 4. Rinsing. 5. Acidulated rinsing. 6. Drying.

Coating time in an immersion process ranges from 2 to 8 minutes and in a mechanized spray process is about 30 seconds. "Alodine" No. 1200 baths are operated at room temperatures (70° to 100°F.) and heating is required only if the bath has gotten cold after a "down" period.

RECOMMENDED USES FOR "ALODINE"

No. 1200

"Alodine" No. 1200 is specifically recommended for coating wrought products that are not to be painted or are to be only partially painted; and for coating casting and forging alloys whether or not these are to be painted. "Alodine" Nos. 100 and 300 are still recommended for coating wrought products such as venetian blind slats, awnings, etc., that are invariably painted.

RESULTS OF TENSILE TESTS

This new "Alodine" not only retards visible corrosion and pitting, but as shown in the table below, the loss of ductility with "Alodine" No. 1200, both brush and dip, after 1000 hours salt spray was less than for chromic acid anodizing after 250 hours, and for "Alodine" No. 100 and a conventional chromate treatment after 168 hours exposure.

PROCESS	SALT SPRAY EXPOSURE	COMPLIANCE WITH TENSILE REQUIREMENTS OF MIL-C-5541
CHROMIC ACID ANODIZING	168 hrs. 250 hrs. 500 hrs. 1000 hrs.	passes passes fails fails
BRUSH "ALODINE" No. 1200	168 hrs. 250 hrs. 500 hrs. 1000 hrs.	passes passes passes passes
DIP "ALODINE" No. 1200	168 hrs. 250 hrs. 500 hrs. 1000 hrs.	passes passes passes passes
DIP "ALODINE" No. 100	168 hrs. 250 hrs. 500 hrs. 1000 hrs.	passes fails fails fails
CONVENTIONAL CHROMATE TREATMENT	168 hrs. 250 hrs. 500 hrs. 1000 hrs.	passes fails fails fails

AMERICAN CHEMICAL PAINT COMPANY

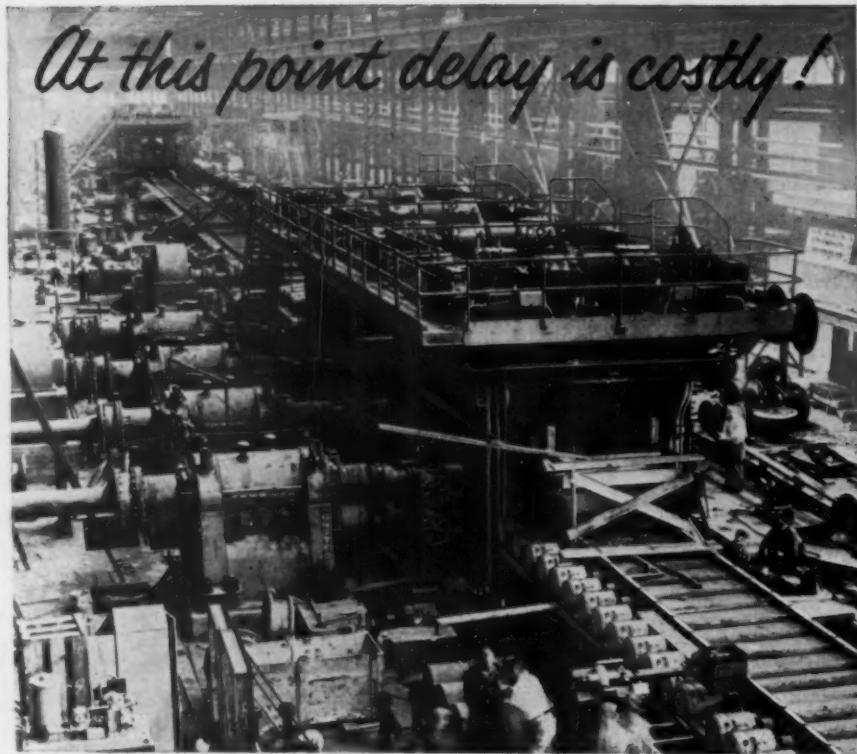
General Offices: Ambler, Penna.

Detroit, Michigan

Niles, California

Windsor, Ontario





Pittsburgh Steel Company's new hot mill at
Alenport, Pa., during installation

THE FINEST steel mill equipment becomes a real asset only after it is properly installed and in operation. The machinery pictured above is typical. Until actual production of finished sheets began, the 28 millions of dollars required to complete this facility earned not one penny.

On this project, as on thousands of others, Commercial Contracting Corporation completed its job—the installation of finishing stands, runout tables, and other equipment—in record time.

Specialists in all types of industrial construction and machinery installation, CCC has built an enviable reputation for doing quality work quickly and economically.

Why not call in this seasoned industrial team to handle your own plant alterations or expansion program?

Whether your project is large or small, every aspect of the work will be supervised by experts, expedited by top management.

CCC services, available to you individually or under one PACKAGE contract, include:

General Construction • Building Alterations • Demolition Foundations • Machinery Installing • Press Erecting • Crane and Conveyor Installing • Equipment Warehousing • Machinery Moving • Steel Fabricating • Export Packaging

Write for complete information without obligation

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12160 CLOVERDALE, DETROIT 4, MICHIGAN • TEXAS 4-7400

—New Equipment—

Continued

Smaller arc welder

New type direct arc welder is smaller, lighter, easier to maintain and more convenient to operate. It has high dependability and requires little maintenance due to an almost complete lack of moving parts. Heart of the welder consists essentially of two parts: a selenium rectifier that converts ac to dc, and a Transactor unit that controls voltage and current. Aluminum has been used instead of copper in the construction of the Transactor unit coils, reducing weight by about 110 lb. *Westinghouse Electric Corp.*

For more data circle No. 27 on postcard, p. 103.

Thermostats

Plastic enclosures on a special series of Thermoswitch thermostats provide severe humidity and corrosion service for long periods of time and under a variety of difficult operating conditions. The unit



may be immersed in most strong and weak acids, alkalis, and salts without ill effect. The thermostats operate at any temperature within a range of 10° to 165°F; can handle a current load of 10 amp at 115 v ac or 5 amp at 230 v ac. *Fenwal Inc.*

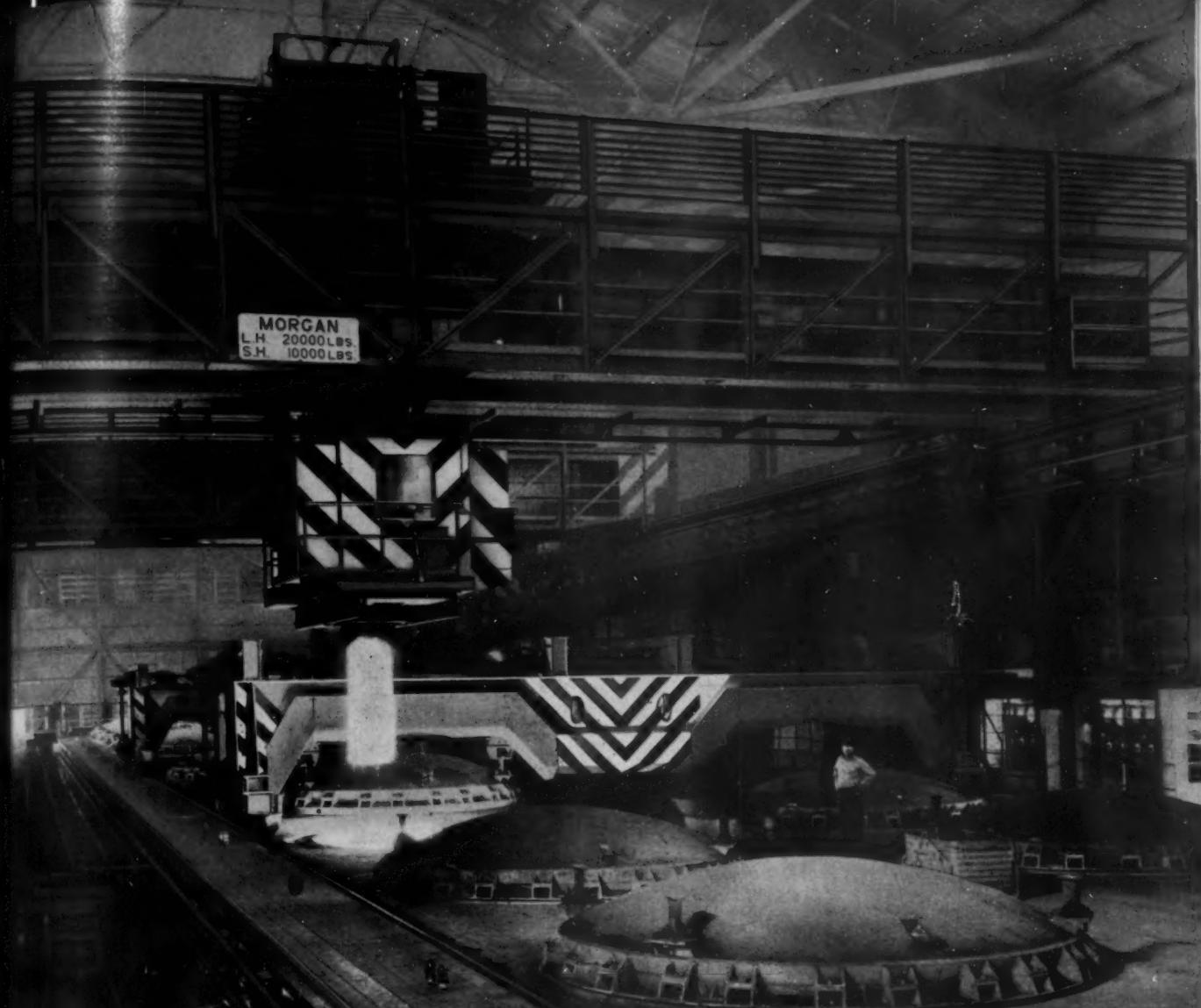
For more data circle No. 28 on postcard, p. 103.

Colored rope

Wirelon ropes are being manufactured in numerous gem-like colors. It is made by a process in which nylon is extruded solidly around a core of wire cable. Addition of dyes to the nylon makes it possible to achieve lustrous, jewel-like effects. Wirelon is said to have up to 500 pct longer life than uncoated cable, is smooth and safe to handle, and withstands abrasion, kinking and corrosion. Sizes range from 3/64 to 1 1/8 in. diam. *Rochester Ropes.*

For more data circle No. 29 on postcard, p. 103.

Turn Page



BUILT BY **MORGAN**
Engineering

MORGAN CRANES AT PUEBLO

Illustrated is one of two Morgan 10-ton, 7-motor, 94'5" span Soaking Pit Cranes at The Colorado Fuel & Iron Corporation's Pueblo Works. These cranes have a tongs range of 15"-30". All motions on trolley are through worm reduction units. The trolley frame, bridge trucks and ram are fabricated and welded into one-piece units.

Morgan has followed very closely the development of soaking pit cranes from the first tower and rack type to the present modern low stiff leg type built with or without counter-weights. Send for Bulletin 32-A.

DESIGNERS
MANUFACTURERS
CONTRACTORS

BLOOMING MILLS
PLATE MILLS
STRUCTURAL MILLS
ELECTRIC TRAVELING CRANES
CHARGING MACHINES
INGOT STRIPPING MACHINES
SOAKING PIT CRANES
ELECTRIC WELDED FABRICATION
LADLE CRANES
STEAM HAMMERS
STEAM HYDRAULIC FORGING PRESSES
SPECIAL MACHINERY FOR STEEL MILLS

THE MORGAN Engineering CO.
ALLIANCE, OHIO • PITTSBURGH — 1420 OLIVER BUILDING

LESS SPACE!

extra high
safety
factor!

NEW T-J
Spacemaker
AIR CYLINDERS

These new T-J Cylinders *save up to 40% in mounting space*—with streamlined design that eliminates tie rods. They're *super rugged*—extra high safety factor . . . solid steel heads . . . heavy wall, precision honed, hard chrome plated, seamless steel body . . . leakproof cylinder head to body construction . . . heavy duty, high tensile, hard chrome plated piston rod.

Available with the new T-J Super Cushion Flexible Seals which insure positive cushion with automatic valve action for fast return stroke. Many standard sizes and styles . . . for pushing, pulling, lifting, clamping or control jobs. T-J dependability. Write for bulletin 8152 The Tomkins-Johnson Co., Jackson, Mich.

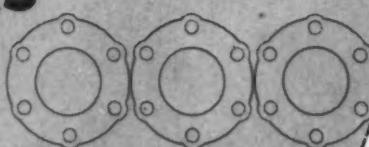


4 Weeks Delivery
on the Space-
maker—any
style, any stroke,
1 $\frac{1}{2}$ to 3 $\frac{1}{2}$ diam.

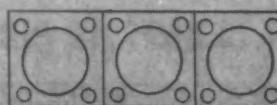
TOMKINS-JOHNSON

VISITORS, AIR AND HYDRAULIC CYLINDERS, CUTTERS, CLINCHORS

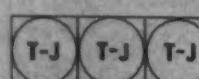
37 YEARS EXPERIENCE



CIRCULAR HEADS
WITH TIE RODS



SQUARE HEADS
WITH TIE RODS



T-J SPACEMAKER . . . provides
additional room for adjacent
equipment without sacrificing
strength.

SPACE
SAVED

New Equipment

Continued

Weld flux

Powdered flux for use, primarily, in the welding of Ampeo 8 and other aluminum bronze sheet and plate may be used with inert-gas processes and bare Amoco-Trode filler rods in all grades. It will insure the removal of oxides from the weld metal and reduce the surface tension allowing the deposit to flow into the side walls more uniformly and produce sounder deposit of improved appearance. The flux is mixed with an alcohol and painted on all surfaces of the joint to be welded. *Ampeo Metal, Inc.*

For more data circle No. 30 on postcard, p. 110.

Bedways

A wide variety of bedway shapes and sizes includes standard ways and those made to specifications. Ohio Knife's own laminating method welds long-wearing high grade tool steel to a soft steel backing un-



der 2500 tons pressure. Special heat treatment super-hardens the ways to a uniform depth of 3/16 in. The hardened surface helps maintain constant accuracy throughout the life of the machine. Hardened ways and gibbs are ground to tolerances of ± 0.0002 in. *Ohio Knife Co.*

For more data circle No. 31 on postcard, p. 110.

Lubricating grease

Molykote Type BR2 is a multi-purpose E. P. lubricating grease for highly-loaded ball and roller bearings and heavily-loaded sliding friction surfaces. The compound is an oxidation-inhibited, lithium base product, fortified for E. P. characteristics with Molykote Type Z, a pure molybdenum disulphide powder. Operating range is from -30° to 350° F. *Alpha Corp.*

For more data circle No. 32 on postcard, p. 110.

Turn Page

NEW! BAY STATE
BZ SAF-T-CUT

... A TRULY
GREAT
REINFORCED CUT-OFF WHEEL



GREATER
SAFETY

GREATER
COOLNESS

GREATER
(10 TO 20%)

GREATER
STRENGTH (100%)

GREATER CUTTING
SPEED (UP 20%)

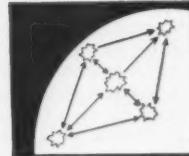
GREATER
RESISTANCE
TO LOADING

ACTUAL TESTS PROVE THAT BZ SAF-T-CUT

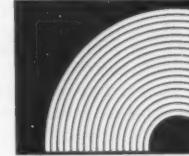
WHEELS ARE... STRONGER... FASTER... COOLER



Reinforced with tough
glass fiber for rugged
STRENGTH and LONG
LIFE.



New "BZ" Bond holds
abrasive particles exactly
right for OPTIMUM CUT-
TING POWER.



New Spiral Grooved sides
give COOLER, CLEANER
CUTTING on the 14" to
20" dia. sizes.



Micro photo shows "air-
cooling" groove design
that adds NON-BURNING
feature.

Development of the new "BZ" bond was aimed at improving safety, cutting rate, and wheel life for all cut-off work on steel bars, pipe, angle iron and other structural shapes, as well as ferrous and non-ferrous castings.

Actual tests show fast, clean cuts on these materials, plus performance records of 10 to 20% better life... and up to 20% faster cutting rate than the best competition.

BAY STATE says to its sales force and to you, "We believe this 'BZ' SAF-T-CUT wheel to be the best reinforced resinoid cut-off wheel on the market today, from every point of view!" Ask for a demonstration.

BAY STATE ABRASIVE PRODUCTS CO., Westboro, Mass.

Branch Offices and Warehouses: Chicago, Cleveland, Detroit, Pittsburgh

Distributors — All Principal Cities

In Canada: Bay State Abrasive Products Co. (Canada) Ltd. Brantford, Ont.

able in Aluminum Oxide abrasive (for
metals), and Silicon Carbide abrasive
(cutting non-metallic materials).
in your BAY STATE REPRESENTATIVE for
size and specification data.



PENINSULAR GRINDING WHEEL CO.
saves time and labor, does a better job with

FARQUHAR **Hydraulic Press**

Five years ago, the Peninsular Grinding Wheel Company, Detroit, Michigan, installed a hydraulic press. Peninsular wanted a press that could mold grinding wheels quickly and well—with a minimum of rejects, that would stand up for many hours of constant use—so it chose Farquhar. And Farquhar does the job! In operation 16 hours a day, 5 days a week, this 300-ton model works smoothly and satisfactorily, cutting time and labor costs. Peninsular particularly likes Farquhar's easy pressure setting and the short ram stroke required—two of the many Farquhar features that contribute to its dependable, money-saving performance.

Farquhar Presses Cut Your Costs
Just one more example of cost-cutting

Farquhar performance in modern production. Farquhar Presses are built for the job . . . assure faster production due to rapid advance and return of the ram . . . greater accuracy because of the extra guides on moving platen . . . easy, smooth operation with finger-tip controls . . . longer life due to positive control of speed and pressure on the die . . . long, dependable service with minimum maintenance cost.

Farquhar engineers are ready to help solve whatever production problem you may have. Give them a call. Send for free catalog showing Farquhar Hydraulic Presses in all sizes and capacities for all types of industry. Write to: THE OLIVER CORPORATION, A. B. Farquhar Division, Hydraulic Press Dept., 1503 Duke St., York, Pa.



THE OLIVER CORPORATION • A. B. FARQUHAR DIVISION

New Equipment

Continued

Sheet wax

Sheet wax with a pressure-sensitive adhesive backing for attaching to all surfaces opens wider fields of use for the product and lessens labor and muss on such jobs as mock-up work in the aircraft industry, and build-up work in the pattern industry. The adhesive-coated wax sticks to any clean oil-free surface and the sheets can be used over and over again if not damaged. Available in thicknesses from 0.007 in. up to 8x12 in. and 12x24 in. standard sheets. Softening point of the wax is 166°-168°; special formulations available to 270°. Kindt-Collins Co.

For more data circle No. 33 on postcard, p. 109.

Mechanical comparator

Checking dimensions of parts at the production line, in the tool room, or inspection department can be accomplished with a Sigma vertical mechanical comparator. Because it is completely mechanical, it sets up anywhere in a plant with-



out making or breaking electrical connections. It has magnifications of 500, 1000, 1500, 3000X and capacities of 6 and 12 in. in each magnification. All moving parts are mounted in ball bearings, reducing friction and wear, and assuring repeated accuracy of readings. Cosa Corp.

For more data circle No. 34 on postcard, p. 109.

THE IRON AGE

The Iron Age

SALUTES

Arthur N. Kugler

He never pushed himself, but years of fruitful service put him in industry's front rank.



WATCHING Art Kugler spin a graceful figure eight you wouldn't be much surprised to learn he and the Mrs. are considered ice-skating champs of North Jersey. You'd be a great deal more surprised to learn that his friends regard him as "Mr. Welding."

You have to learn about Art's accomplishments from his friends—he won't tell you. But we can tell you they are too numerous to allow more than a bare sketch of the high spots.

During 25 years in welding he has boosted that industry by intensive development of applications in other industries. Extensive work includes welding piping for oil, gas, steam, water service; participation in development of multilayer oxyacetylene welding of carbon molybdenum steel pipe.

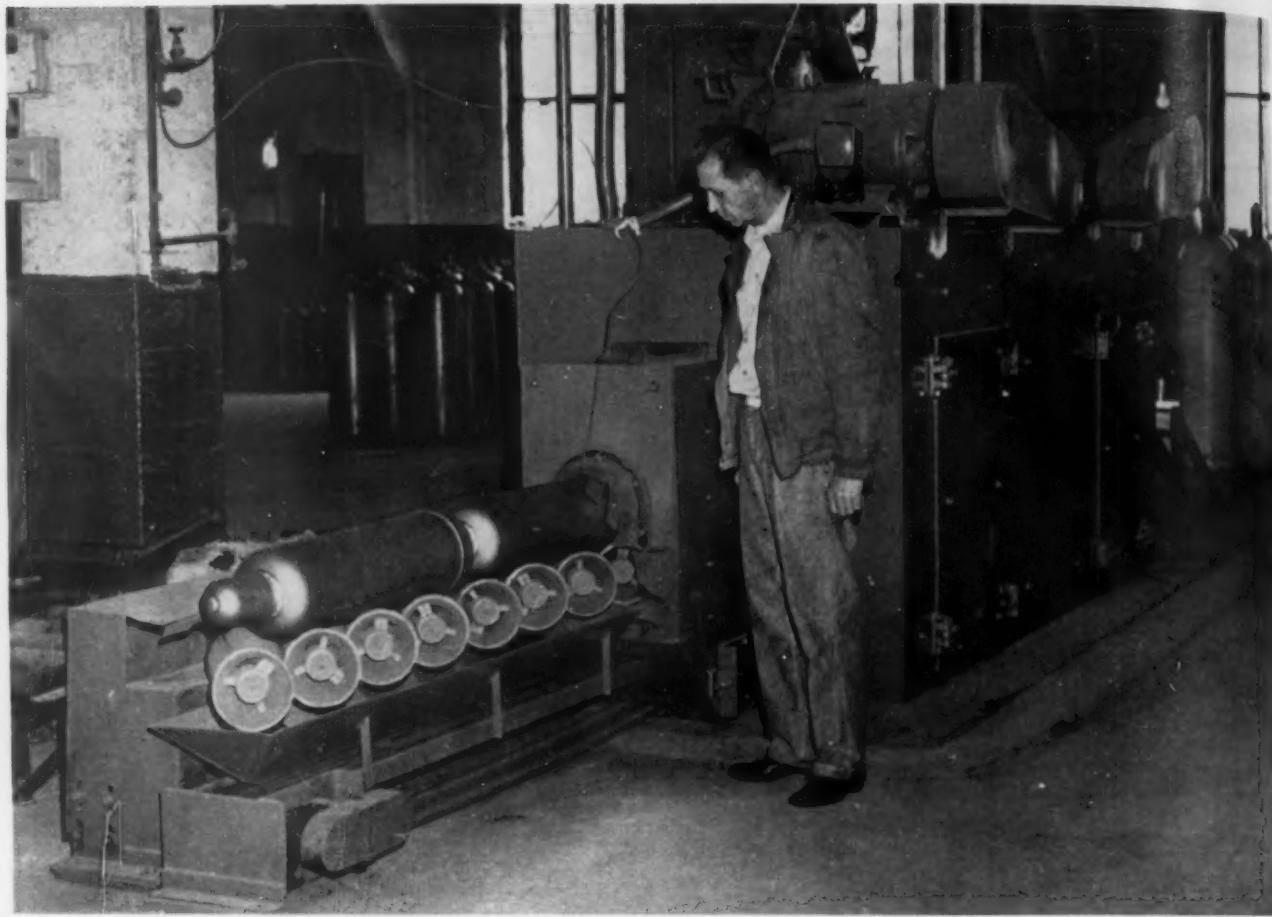
He's author of many papers on oxyacetylene and arc welding, has contributed to a number of handbooks, manuals. He has taught welding engineering at Pratt Institute, and has acted as consultant to the Army.

Also there are many committees to which he has faithfully rendered valuable service on such diverse subjects as safety, training, technical activities, inspection, building codes, and various phases of welding.

Despite his many contributions, the Chief Welding Engineer of Air Reduction Co. has never pushed himself; years of fruitful service have convinced people they can count on Art Kugler.

Personal Notes: He's building a log cabin in a New Jersey forest, cutting down trees, splitting the logs, a la Abe Lincoln. He has one daughter—married to an engineer, of course.

pioneering developments keep **WHEELABRATOR®** first in blast cleaning



avalanche of steel shot cleans used cylinders one a minute

*an example of the savings possible
reconditioning used parts with a Wheelabrator*

The time it takes to restore used parts to good-as-new condition is drastically cut by use of Wheelabrator Airless Blast Cleaning Equipment. For instance, it previously took 8 hours by manual wire brushing and airblasting to strip old paint and remove surface corrosion from just 16 compressed gas cylinders at Independent Engineering Co., O'Fallon, Illinois. Quality of

cleaning was also unsatisfactory. The Wheelabrator Cabinet, illustrated above, now thoroughly and uniformly cleans these pieces at the rate of 60 per hour. Cleaning is continuous as the cylinders pass through the avalanche of steel shot thrown from the Wheelabrator blast units. More and more used parts are being profitably reconditioned with the help of Wheelabrator blast

cleaning. Old paint, rust, and other foreign materials are removed for a fraction of the cost of other methods to simplify reconditioning operations. The Wheelabrator's fast, thorough and low-cost cleaning creates new profit possibilities in the reconditioning of trade-ins and leased machinery, auto parts, electrical equipment, pipe, structural steel, valves and fittings, etc. Time and cost savings can be demonstrated on your products in the Wheelabrator laboratory. There is no cost or obligation. Write now for details.



Bulletin 74-B tells
"What the Wheel-
abrator is and what it
Will Do For You."
Send for a copy today.

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WHEELABRATOR & EQUIPMENT CORP.
510 S. Byrkit St., Mishawaka, Ind.



The Iron Age

INTRODUCES

A. W. Geier, elected assistant treasurer, AMERICAN CAN CO., succeeding **J. E. Surver**, who has retired. **C. D. Polhamus**, appointed credit manager, Atlantic Div.

Harold O. Washburn, elected to chairman of the board, AMERICAN HOIST & DERRICK CO., St. Paul, Minn.

Henning W. Prentis, Jr., and **Col. Willard F. Rockwell**, elected to the board of directors, AMERICAN LOCOMOTIVE CO., Schenectady.

Geo. C. Simon, elected a director, THE WILSON SPRING CO., INC., Newark.

Luther S. Smith, becomes special assistant to the president, TEMCO AIRCRAFT CORP., Dallas.

Grant S. Diamond, elected vice-president, GRINDING WHEEL INSTITUTE, Cleveland.

Charles W. Punton, appointed director of engineering, MINE SAFETY APPLIANCES CO., Pittsburgh.

Sidney F. Kaufman, becomes engineer, carbide powder processing and fabrication development unit, Carbo-loy Dept., GENERAL ELECTRIC CO., Detroit; and **M. L. Smith**, rejoins the Dept. as a marketing trainee in the permanent magnet field.

Russell A. Moore, appointed field applications engineer, THE BAKER-RAULANG CO., Cleveland.

Joseph J. Schaefer and **Francis B. Bryant**, appointed sales engineers, UDYLLITE CORP., Chicago regional sales office.

Henry A. Leilich, appointed project engineer, Machinery Div., DRAVO CORP., Pittsburgh.

Stanley G. Harris, appointed general supervisor of costs and statistics, American Steel & Wire Div., UNITED STATES STEEL CORP., Cleveland; he succeeds **John W. Jordon**, who has been transferred to Pittsburgh to serve as assistant to executive vice-president—Accounting.

Joseph C. Anton, named superintendent of construction, Indiana Harbor plant, THE YOUNGSTOWN SHEET & TUBE CO., East Chicago, Ind.

Robert R. Cyeon, appointed chief cost accountant, LINDBERG STEEL TREATING CO., Melrose Park, Ill.

L. A. Kilgore, appointed staff engineering manager, East Pittsburgh Divisions, WESTINGHOUSE ELECTRIC CORP.

Michael Darkock, named superintendent of warehousing, Pittsburgh District, L. B. FOSTER CO.

H. Clay Davis, appointed manager of coke and coal chemical sales, WOODWARD IRON CO., Birmingham, Ala.

Harvey C. Blesch, named manager, St. Louis office, A. MILNE & CO.; and **John I. Kitts**, appointed manager, Cleveland office.

Gaetan M. Zucco, rejoins Fabricated Steel Construction Div., as contracting manager, Los Angeles district, BETHLEHEM PACIFIC COAST STEEL CORP.

B. A. Kline, appointed sales manager, BIRDSBORO STEEL FOUNDRY & MACHINE CO., Birdsboro, Pa.

Charles M. Offenhauer, named assistant manager, Metals Research Laboratories, ELECTRO METALLURGICAL CO., Niagara Falls, N. Y.



A. L. FOSCUE, appointed president, Electro Metallurgical Co., and U. S. Vanadium Co., divisions of Union Carbide & Carbon Corp.



JOHN A. MATOUSEK, named vice-president and general manager, The Baker-Raulang Co., Cleveland.



G. S. WILLIAMSON, elected vice-president—Manufacturing, The Ai Res Mfg. Divisions, The Garrett Corp.

Personnel

Stephen A. Stoney, appointed assistant to the manager of industrial relations, NATIONAL LEAD CO., New York. Albert L. Culbertson, becomes director of personnel and industrial relations at Fernald, Ohio, plant.

F. Robert Campbell, appointed packaging manager, NATIONAL GYPSUM CO., Buffalo.

James R. McBrien, named manager, North Central Div., THE DIVERSEY CORP., Chicago.

Charles D. McCall, appointed manager of automotive engineering, within the Engineering Dept., New Departure Div., GENERAL MOTORS CORP., Bristol, Conn.

A. J. Snyder, appointed sales manager, Cutting Tool Sales Div., THE MOTCH & MERRYWEATHER MACHINERY CO.

Rex E. Galloup, appointed district manager, Texas and Gulf Coast area, EDWARD VALVES, INC., East Chicago, Ind.

H. J. Hunkele, transferred to Engine Div. as assistant manager, Industrial Sales, CATERPILLAR TRACTOR CO., Peoria; C. B. Leber, promoted to assistant sales manager, Plains Div.

Frank Watt, named general sales manager, Metal finishing and foundry divisions, FREDERIC B. STEVENS, INC.; and Guy Cummings, becomes sales manager, metal finishing div.

Robert W. Bales, appointed assistant territory manager, Chicago and Northern Illinois, CORY CORP.

S. E. Brennan, appointed manager of budget control, Kaiser Willys sales division of WILLYS MOTORS, INC., Toledo.

Robert H. Bergen, and Robert A. Wilson, named district sales managers, DEWALT, INC., Lancaster, Pa.

Morgan Ricks, appointed division manager, Midcontinent area, Colona Mfg. Div., PITTSBURGH SCREW & BOLT CORP., Tulsa headquarters.



C. W. REYNOLDS, elected vice-president of public relations and industrial relations, The Garrett Corp.



ERNEST R. SCOVIL, named secretary and treasurer, The Baker-Rau Lang Co., Cleveland.



GEORGE G. ZIPF, appointed superintendent, Tubular Products Div., The Babcock & Wilcox Co., Beaver Falls, Pa.



M. E. DORMAN, appointed manager of materials, Canton Div., E. W. Bliss Co., Canton, O.



THIS wide span, three motor, cab-controlled crane embodies exactly the features that are needed for assembly floor operations. Rapid speed of travel laterally and longitudinally—hoists of two capacities for lifting—ease of operation including precision magnetic control which is so essential in assembling vital components of valuable machines. And, of course, characteristic Euclid low operation and upkeep costs which have established an unexcelled record for repeat orders from discriminating purchasers.



THE EUCLID CRANE & HOIST CO.

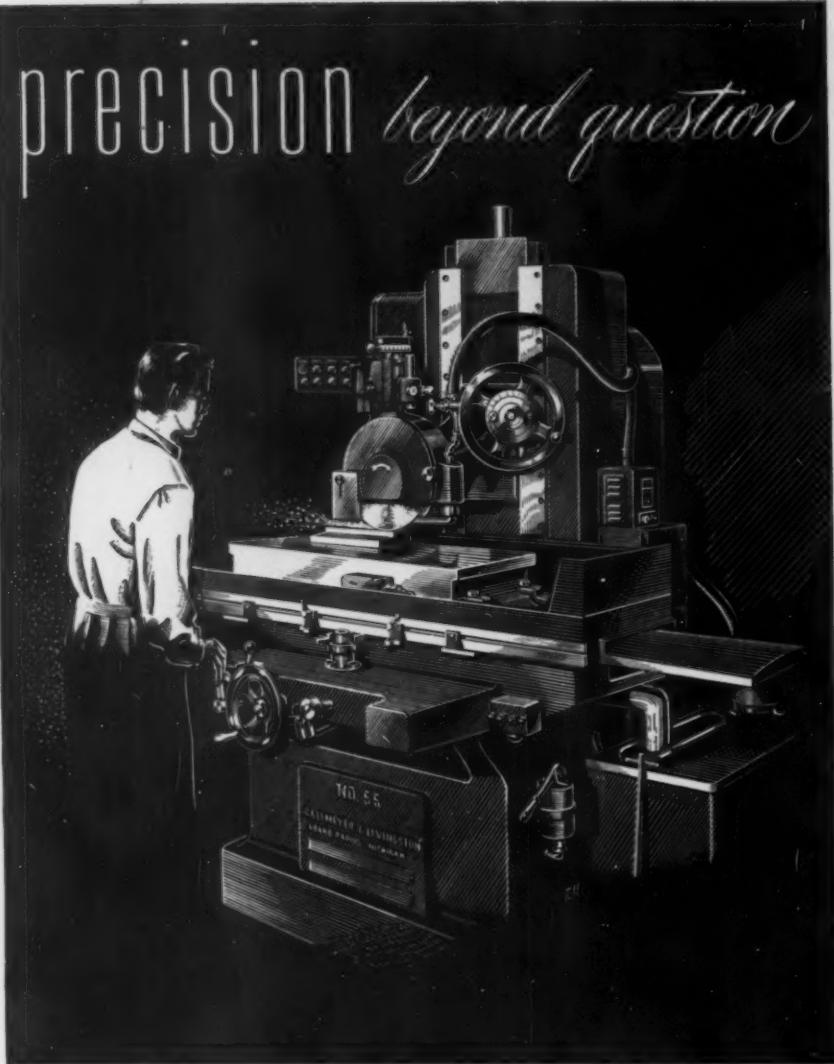
1361 CHARDON ROAD • EUCLID, OHIO



production PLUS

The COPYMATIC Tracer-Controlled Lathe proves that accuracy at production rates is possible and profitable. In unanimous reports, owners state their Lodge and Shipley COPYMATICs save up to 87%, pay for themselves in a year or two! Write for NEW Catalog No. 216. The Lodge & Shipley Company, 3055 Colerain Avenue, Cincinnati 25, Ohio.

Lodge & Shipley
...your LODGE-ical choice!



The requirements exacted of surface grinding machines leave no room for variation. Precision and tolerance control must be built-in. Through the years Grand Rapids Grinders have demonstrated the highest quality and unquestioned dependability of performance. Upon this record they have been accorded world-wide acceptance as standard of the industry. Here is precision beyond question.

GALLMEYER & LIVINGSTON CO., 200 Straight Ave., Grand Rapids, Mich.

GRAND RAPIDS
GRINDERS

MANUFACTURERS OF
SURFACE GRINDERS, CUTTER AND TOOL
GRINDERS, TAP AND DRILL GRINDERS



Personnel

Continued

W. N. McArdle, appointed Chicago district sales manager, ROTARY ELECTRIC STEEL CO., Detroit.

William J. Westphale, Jr., appointed district sales manager, Chicago office, FUSITE CORP., Cincinnati.

Fred N. Eaton, appointed works manager, Foundry Div., ALUMINUM INDUSTRIES, INC., Cincinnati.

Richard M. Vail, appointed sales manager, DRAKE STEEL SUPPLY CO., San Diego.

R. A. Knight, appointed assistant sales manager, Equipment Division, NATIONAL RESEARCH CORP., Cambridge, Mass.

Arthur E. MacNall, appointed Detroit district sales manager, TINNERMANN PRODUCTS, INC., Cleveland.

Allen D. Foote, appointed works purchasing agent, West Allis Works, ALLIS-CHALMERS MFG. CO., Milwaukee.

John Greeley, appointed manager, Seattle office, OREGON STEEL MILLS, Portland.

Truman L. King, appointed labor relations manager, WAGNER ELECTRIC CORP.; and **R. A. Weiskopf**, becomes personnel relations manager.

William I. Tierney, named personnel superintendent, MONSANTO CHEMICAL CO., Anniston, Ala., plant.

OBITUARIES

Herbert P. Ramsey, 51, owner, Ramsey Metal Products Co., Birmingham, Ala., recently, near Goodwater, Ala., when his automobile crashed into a telephone pole during a rainstorm.

Lester J. Ross, 63, president, The Torrington Co., Torrington, Conn., at his home at Litchfield, Conn., after a heart attack.

John T. Jones, 35, Sales Dept., Vesuvius Crucible Co., Pittsburgh.

Fred A. Tobitt, Sr., 71, retired sales consultant, Armco Steel Corp., Middletown, Ohio.



WELDING



Jigs and Fixtures Increase Welding Output	P. 138
What Are the Best Ways to Weld-	
Stainless Steel.....	P. 142
Magnesium Alloys.....	P. 145
Inconel.....	P. 150
Prevent Flux Penetration in Braze Aluminum	P. 148
New Alloys Stop Corrosion in Silver-Brazing 430.....	P. 159
How to Solve Tough Hard-Facing Problems.....	P. 164
Welding As a Maintenance Tool.....	P. 168
Resistance Welding—Where and How to Use It	P. 172
Safety Tips on Welding.....	P. 177
Welding Briefs.....	P. 182
Welding Notebook	P. 233



JIGS AND FIXTURES

Increase Welding Output



By Thomas J. Wood

General Welding Foreman
The American Welding & Mfg. Co.
Warren, Ohio

- ◆ Key to mass production of high quality weldments is the well designed jig or fixture . . . Today, assemblies of 50 or more parts are easily handled in properly designed fixtures.
- ◆ Good fixtures improve work flow, make the welding assembly operation more orderly . . . More functions are being "built in" . . . Heat conducting materials are used to speed removal of heat from the welding area . . . Allowances are included to offset distortion.
- ◆ Accuracy is the first requirement . . . Easy accessibility for the welder is important . . . Above all, the jig or fixture must be able to amortize itself within a reasonable time in terms of increased output and improved quality.

◆ PROPERLY DESIGNED jigs and fixtures save money, improve the quality and speed the production of weldments. Careful planning in the design stage will permit incorporation of several welding operations in one set-up or positioning. Good jigs and fixtures impart an orderliness to work flow by bringing together the parts to be welded and by grouping the welding operations needed to complete a job with minimum of delay.

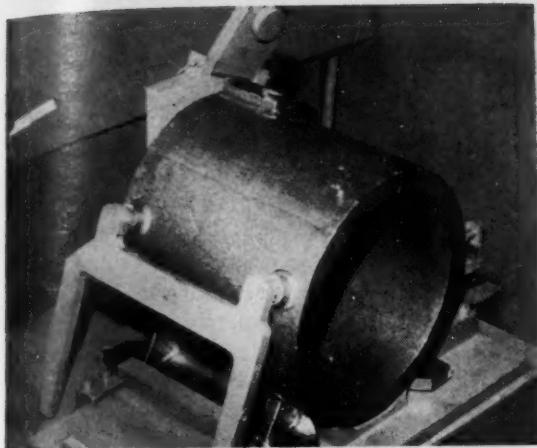
Except in isolated instances, use of jig or fixtures for welding work pays off handsomely at The American Welding & Mfg. Co. A layout man is still needed for simple jobs where a few simple parts are involved, assembly is relatively simple, and the number to be made is small. But, without the intensive development of welding jigs and fixtures, it would be difficult to

handle—on a mass production basis—the many items now designed for production as weldments.

Just as welding techniques are constantly being improved and broadened, more functions are being incorporated into the well designed welding fixtures.

Demands of the jet program during the past few years have overturned earlier concepts of the number of parts which could be handled in a fixture. Not too long ago it was felt that 10 or 12 components were the limit which could easily be handled in a fixture. Now fixtures are designed to handle as many as 50 components.

In many cases, welding jigs and fixtures are designed as to offset distortion caused by welding. It may be necessary to over-bend a part to compensate for shrinkage following



TWELVE COMPONENTS for motor frame are positioned in this fixture for tacking. The assembly is removed for metal arcwelding.

welding. At times, various heat-conducting materials are used in building a fixture to speed removal from the welding area of heat which, if allowed to dissipate too slowly, might be injurious to the finished product.

Welding jigs and fixtures can also be designed so that joints are spaced apart or held closely together. In many cases, very close tolerances are held by precision welding the parts in a fixture carefully designed to locate the components with great accuracy.

Jigs and fixtures are usually designed around a frame or main part to components of an assembly are to be added. Stops must be provided to place these components in proper relationship to each other. Clamps are needed to hold parts in position while the overall assembly is tacked or finish-welded.

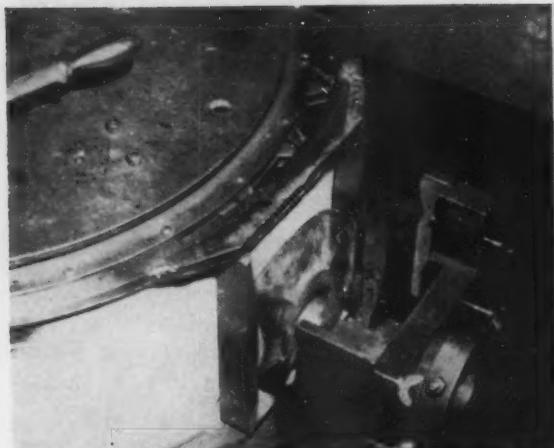
Primary requirement is that the fixture be accurate so each assembly made will be of the same quality. It must be strong enough to withstand the wear and tear of loading and unloading parts. It must be simply designed so that it is easily accessible for positioning of the various parts.

Easy accessibility for the welder is another qualification of a good fixture. The welder must be able to work from the best angle, generally a down-hand position. Finally, the jig or fixture must be made as nearly foolproof as possible, reducing the number of possible errors and making it available for use by more workmen.

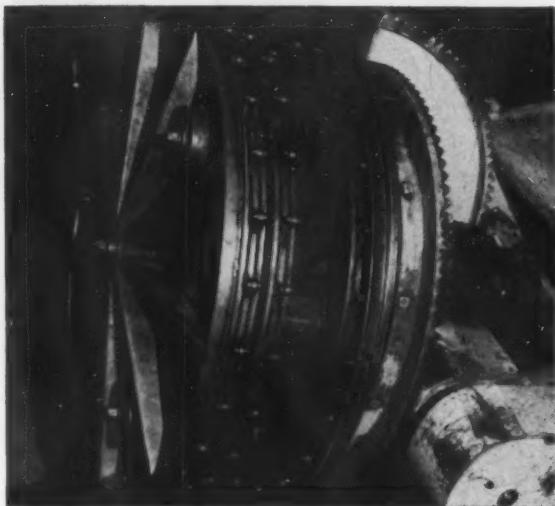
The one over-riding requirement is that a jig or fixture amortize itself within a reasonable time in terms of improved quality or increased output of work, or both.

A number of jigs and fixtures used in production lines at American Welding have been in service for several years and have produced many hundreds of pieces or assemblies. Others are still fairly new. Together these illustrate the extent to which jigs and fixtures can be used to advantage in production welding work.

The frame for a direct current motor is repre-



TRUNNION PAD assemblies and fuel collector for turbine casing assembly are grouped in multi-purpose fixture. Cams actuate expanders.



MULTI-PURPOSE FIXTURE, used in assembly of jet turbine casing rings, positions parts axially and radially. Backup rings control weld depth.



FINISHED TURBINE CASING, metallic hand arcwelded meets high standards of quality. Three 36-in. rings of machined stock are joined to two 0.090-in. thick bands.

Any good fixture provides easy accessibility for the welder. He must be able to work from a suitable angle, preferably downhand.

sentative of work where the primary job of the fixture is to locate and hold component parts for preliminary tacking or final welding. The fixture, designed and built in American Welding's shops, is used to position 12 components for tacking before welding.

Metallic arcwelding on the parts which form the finished assembly is done after removal of the tacked frame from the fixture. The welding

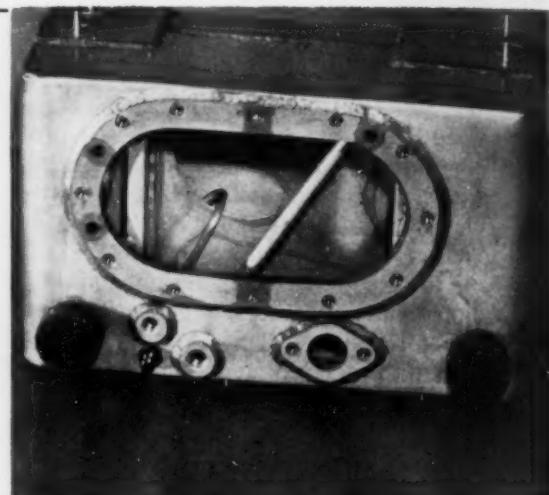
fixture consists of hinged base holders at left and right, conduit box holder at rear and two base plates or sliding platens for the accurate positioning of motor feet and gussets. Loading and unloading is simple and rapid.

Because the fixture permits all parts to be set up at one time, three additional handling operations which would otherwise be required have been eliminated.

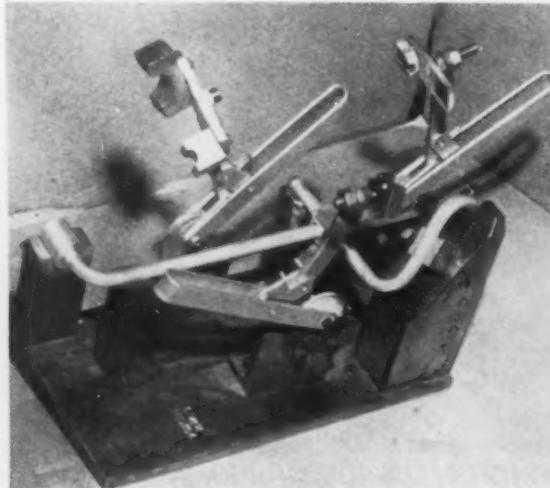
A turbine casing for jet aircraft required use of multiple-purpose fixtures and posed the problem of joining three 36-in. rings of machined stock to two 0.090-in. thick bands; then adding four ring stiffeners, two trunnion pads and a fuel collector.

Multipurpose fixtures have made possible the highest quality welding while at the same time immensely simplifying the handling and weld-

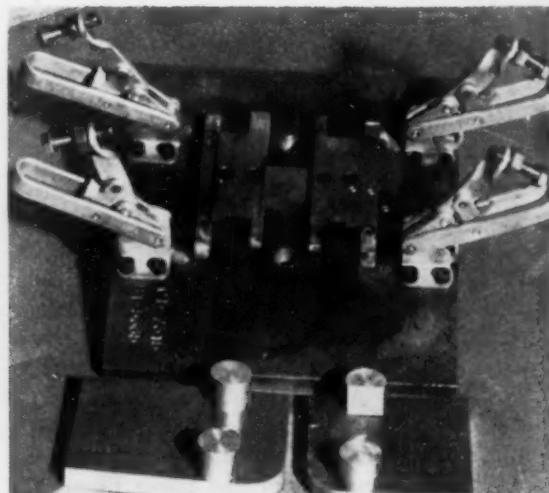
These photos show some of the 14 jigs and fixtures designed primarily to position 43 components of an aluminum turbine oil reservoir prior to inert arcwelding. Photo at the right shows the completed reservoir.



WELDED ALUMINUM oil tank has 43 components, requires 14 jigs and fixtures to assemble it.



PREFORMED ALUMINUM tubing, two nuts and a 4-way tee are held in this fixture for tacking.



BOSSES ARE TACKED to 1/2-in. aluminum pads of oil reservoir. Bosses are later joined to tubing.

ing of the several parts used in the assembly.

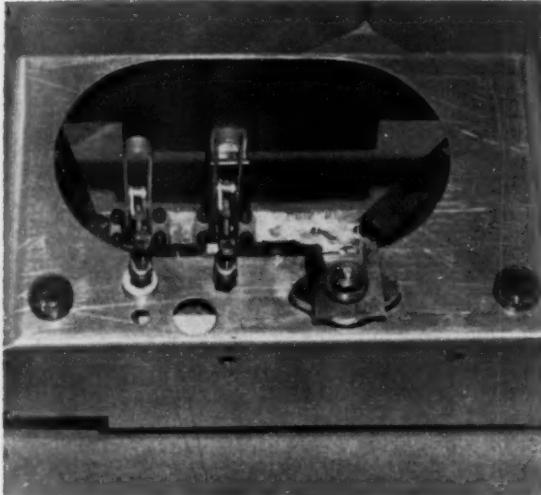
First multipurpose fixture used not only positions parts axially and radially, but controls through use of back-up rings the depth of the weld itself. Three cam-actuated spiders expand the back-up rings against the parts to be welded, exerting sufficient pressure to compensate for shrinkage during welding. Dissipation of heat in the weld area along the paths provided by the back-up rings assists in controlling depth of the weld.

Somewhat similar in operation is a multipurpose fixture designed for locating four ring stiffeners, two trunnion pad assemblies and a fuel collector element. A double-acting cam mechanism provides both axial and radial stressing of the rings prior to welding.

Welding assembly of a turbine oil reservoir,

"Primary requirements for jigs and fixtures are that they be accurate, strong, and simple for easy loading and unloading . . ."

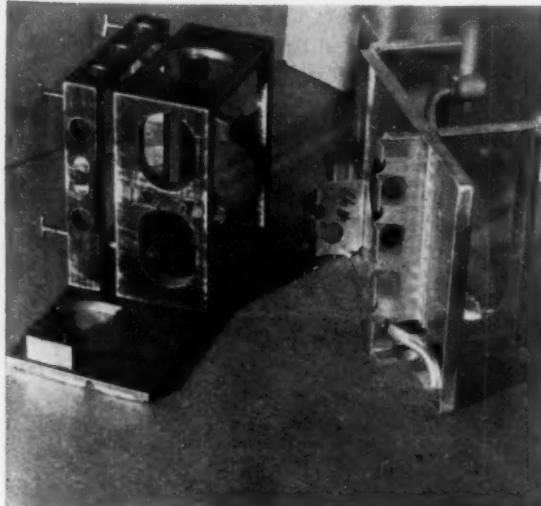
involving 43 aluminum parts, requires 14 jigs and fixtures designed primarily to position the components prior to inert arcwelding. Precise positioning is necessary. There is both inside and outside welding and assembly of relatively small parts. Approximate overall dimensions of the oil reservoir are $16\frac{1}{2} \times 9\frac{5}{8} \times 7$ in. Work was broken down into subassemblies and the completed tank has to pass rigid inspection as well as pressure tests.



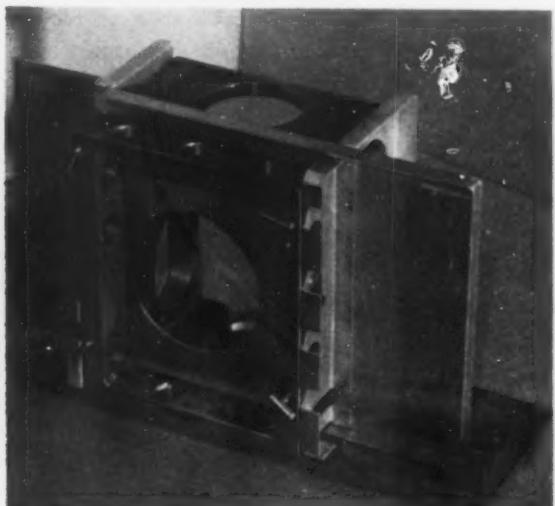
QUICK, ACCURATE location and tacking of two bosses and two filler caps are done here.



LOCATION OF interior assembly to bottom half of oil reservoir is simplified with this fixture.



INTERIOR TANK STIFFENERS are positioned in this fixture. Components—two bases, a connect-



ing plate and riser—are spot welded. Final welding is done with assembly in fixture.



Proper Technique Gives Stainless Good Weldability



By Roy E. Solomon

Welding Engineer
Research Laboratory
Allegheny Ludlum Steel Corp.
Brackenridge, Pa.

- ♦ Stainless steels have excellent weldability if a few basic procedures are observed . . . Experience in handling equipment and knowledge of properties affecting behavior of metal are main stepping stones to successful welds . . .
- ♦ Relatively low current, small diameter rod and stringer bead technique produce best welds . . . Short arc provides better weld zone protection and results in superior corrosion resistance and appearance . . . Preheating benefits crack-sensitive stainless steels and helps all types during cold weather.
- ♦ WELDABILITY of stainless steels is excellent as evidenced by the large amount and wide variety of welded equipment in service. Almost every type of stainless steel can be readily welded by any conventional method, except hammer or forge welding. The mechanics of producing strong, sound welds is merely a matter of experience with the equipment involved. Persons not experienced in welding stainless steel must follow certain basic procedures, varying slightly from those in welding plain carbon steel, to obtain satisfactory joints.

An important point for the welder to con-

sider is that stainless steels are used for a particular service involving corrosion resistance, decorative or other special conditions. For this reason, welds which would be satisfactory with plain-carbon steel may not be suitable in meeting these more critical conditions.

In the case of corrosion resistance, poor welding technique may seriously impair the normal characteristics of the metal and result in early failure of the equipment. For decorative applications, uniform deposits with no undercutting are necessary to facilitate finishing operations. In other cases, porosity or cracking may affect behavior in service. Welding of stainless steel, therefore, requires more detailed attention than does welding of many other construction materials.

The welder should first become acquainted with the properties of the more than 30 types of stainless steels. Such information can be obtained from manufacturers of these steels.

Special attention is directed to those properties which affect the behavior of the metal under the heat of the operation. These are the melting point, thermal conductivity, and thermal expansion.

Stainless steels have a lower melting point and lower thermal conductivity than plain steel. The chromium-nickel types (300 series) also have a higher coefficient of expansion. It is important for the welder to take steps whereby their effects can be controlled or held to a minimum.

Because stainless steels have a lower melting point, they require less heat input to fuse than ordinary steel. Excessive current will cause improper fluidity of both metal and flux. Lower thermal conductivity points out the need for carrying away some heat by using chill plates

or backup bars. With heavy thicknesses, small-diameter welding rods will accomplish the same purpose. Following these precautions will avoid undue warpage and distortion.

One of the most common faults in welding stainless steel is trying to cover too much ground in a single pass. With thin material, single-pass welding is the only way open, but by controlling current and welding speed, most troubles can be avoided. For decorative trim or food-handling equipment, the weld area must be free of undercutting and weld spatter to facilitate mechanical surface finishing. This requires currents just high enough to obtain good fusion and fast welding speed.

Make weld with stringer beads

Use of large-diameter rods in welding thick material, where a large volume of weld metal is involved, can lead to serious difficulties. In most instances, a 3/16-in. diam rod is the maximum that should be used. Larger diameter rods require high currents and the operator has a large volume of molten metal to control. Weaving usually ensues in such cases, resulting in a poor, irregular weld deposit. Higher current also produces excessive heat which, due to low thermal conductivity of the metal, is confined to a relatively small area.

This procedure produces a highly stressed weld zone along with excessive warpage or distortion. Corrosion resistance of the base metal adjacent to the weld may also be seriously impaired. It is far better to make the weld with several stringer beads using smaller diameter rods. The smaller volume of heat and molten metal affords more rapid cooling.

Weaving the arc laterally to fill a specific void is often used even with small diameter rods. This should be completely avoided for several good reasons. First, heat confines itself

WELDING CHARACTERISTICS

of Principal Stainless Steels

AISI Type No.	Grade	GROUP A		Characteristics of Weld Area
		Weldability		
403	12 Cr TB	D		Hard, brittle
410	12 Cr	D		Hard, brittle
416	12 Cr FM	P		Spongy, porous
431	18-1	D		Hard, somewhat ductile
GROUP B				
405	12 Cr NH	G	Nonhardening, somewhat ductile	
430	17 Cr	G	Partially hardenable, somewhat ductile	
GROUP C				
302	18-8	E	Ductile, tough	
303	18-8 FM	P	Spongy, porous	
304	18-8 S	E	Ductile, tough	
310	25-20	E	Ductile, tough	
316	18-8 Mo	G	Ductile, tough	
317	18-8 S Mo	G	Ductile, tough	
321	18-8 (Ti pet 4 x C)	G	Ductile, tough	
347	18-8 (Cb pet 10 x C)	G	Ductile, tough	

Weldability

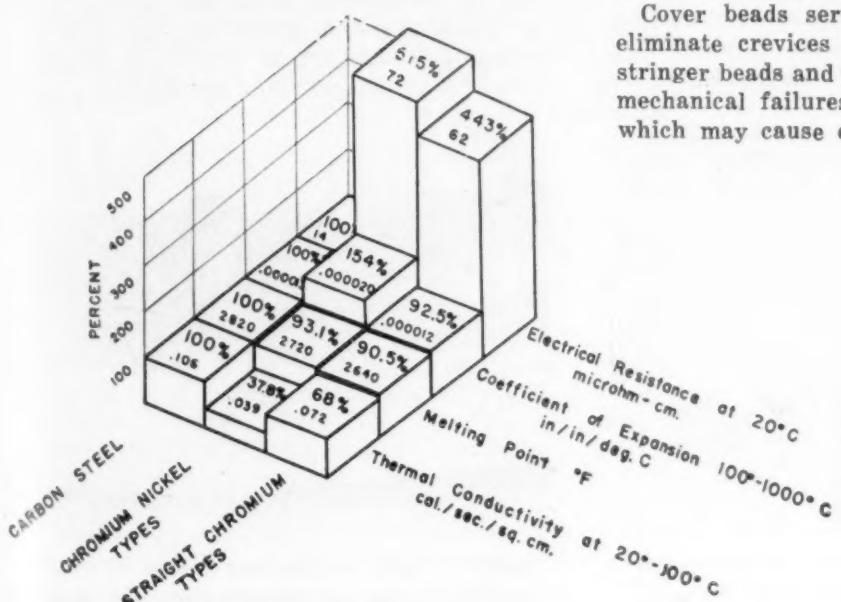
E—Excellent
G—Good
D—Difficult
P—Poor

to a small area, but most important is the possibility of some flux being trapped in the weld deposit.

When slag from a coated electrode freezes, it must be removed before depositing additional metal. When weaving over a wide area, slag or flux may freeze when the arc is moved away and additional metal deposited with the returning arc covers the solidified flux. Increasing the heat will not remelt and float the frozen slag to the top. Removal can only be accomplished by chipping, grit blasting or other mechanical means.

If the metal is not of a crack-sensitive composition, weaving to the extent of 2½ times the electrode diameter is considered permissible. Weaving of the arc is practical only when it is applied as a cover bead. Such welds can be made at low currents and fast welding speeds without concentrating on deep penetration.

Cover beads serve several purposes. They eliminate crevices which remain from laying stringer beads and thus avoid the possibility of mechanical failures due to notching, or voids which may cause corrosion. They also act as



PROPERTIES affecting behavior of stainless during welding need special attention from welder. Graph shows them compared with carbon steel.

strength builders and give the weld deposit a finished appearance.

It is highly desirable that a weld deposit be nearly the same in composition as the base metal. Manufacturers of welding rods usually adjust the analysis of the metal to compensate for normal losses common to all welding operations. However, if a proper arc is not maintained, excessive amounts of essential elements are lost and the weld deposit will not have the same corrosion resistance as the base metal.

Coated rods provide protection

In electric arc welding, coated rods provide a protective blanket which prevents excessive oxidation of the molten metal by the surrounding atmosphere. The flux or coating also has a wetting action which helps to fuse the molten metal with the base metal. This flux or coating always has a lower melting or freezing point than the metal. Thus, it not only protects the molten metal from oxidation in passing through the arc, but also after it has been deposited.

The full benefit of the protection afforded by the flux is obtained with as short an arc as possible. If a long arc is used, the distance between the end of the electrode and the molten pool is too great for adequate protection. This not only lowers the chromium content of the deposit, but also produces a burnt-like condition which is unsatisfactory from the standpoints of resistance and appearance. Undesirable craters may also result.

In joining thick material, edges must be prepared to obtain complete penetration. Where it is possible to weld from one side only, the danger of burn-through exists unless the joint area is accessible and backup plates can be used. Beveled V-shaped grooves are necessary in all cases, but the absence of backup plates may result in incomplete penetration and flux pockets.

Though most welding is done from one side, a small cover-up bead on the opposite side should be laid if possible. Back-grinding or

chipping of the initial weld deposit should be done prior to the final weld to obtain quality joints.

Where it is possible to weld from both sides, double-V grooves are desirable. To hold edges in alignment, tack welds of sufficient strength are made on the side opposite to the one on which the initial bead is laid.

After welding the first side it is best to remove the tacks by grinding before welding the opposite side. If the tack welds are not removed, slag pockets may be present. Welded vessels requiring radiographic inspection should be fabricated only under the most exacting conditions to meet such specifications and avoid costly weld repairs.

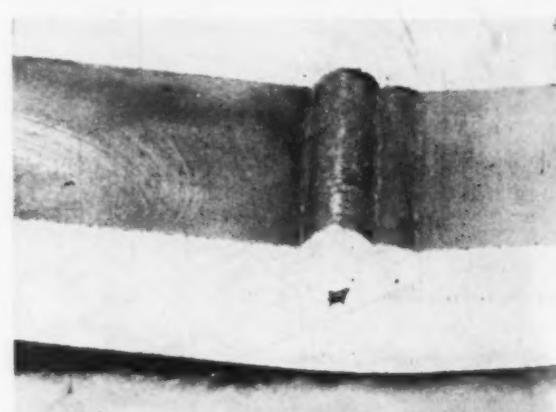
Preheating is often beneficial when welding the crack-sensitive types of stainless steel. In all cases during cold weather, it is desirable to bring the metal up to at least room temperature before welding. Chromium-nickel types 310, 316 and 317, and all straight-chromium steels (400 series) are less susceptible to weld cracking when preheated to about 300° to 500°F.

Clean surfaces are very essential in welding stainless steel. All grease, oil or layout markings should be completely removed from the weld areas. Such surface contaminants may materially increase the carbon content of the weld and result in a brittle deposit with poor corrosion resistance. In removing any of these substances from the surface, it is best to use a strong detergent or organic solvent rather than sandblasting, wire brushing or other mechanical methods.

In making the welds, the operator should strive to facilitate finishing operations. Weld spatter should be held to a minimum as it must be removed before the product can be placed in service. Repair work often presents finishing difficulties, and every effort should be made to avoid it. Details such as removing flux well back of the starting point with a new rod, excessive arcing and spattering, and clean surroundings should not be overlooked. They help greatly to reduce finishing operations.



INTERGRANULAR attack shown in photograph above is caused by excessive heat in weld.



SLAG inclusion results from failure to remove weld flux before depositing subsequent bead.



Inert Gases Prevent Oxidation, Speed Welding of Magnesium

By R. L. Nelson

Technical Service & Development
Magnesium Dept.
Dow Chemical Co.
Midland, Mich.

- ♦ Practically all forms of magnesium weld easily by arc and spot welding methods . . . It is also seam, flash and pressure welded, but to a lesser extent . . . Joining methods include brazing and soldering . . . Inert gases, helium and argon, offer excellent protection to weld zone.
- ♦ Some aluminum content in magnesium aids weldability . . . Tensile strengths of arcwelds are about 90 pct of those for annealed parent metal . . . Butt and fillet joints are preferred, but lap joints can be used . . . No significant difference exists between welds made with direct current and alternating current.

- ♦ MAGNESIUM ALLOYS in virtually all forms are readily welded by arc and spot welding. Successful welds have been made by seam and flash welding but these methods have not been used as extensively as spot welding. Pressure welding has not been performed commercially in the United States. Stud welding with use of magnesium studs appears practical for some applications.

Due to the low melting point of magnesium, low latent heat of fusion, and specific heat per unit volume, the amount of heat required to melt the metal is relatively low. However, high thermal conductivity and coefficient of thermal expansion may cause distortion of magnesium

during welding unless suitable precautions are taken.

Rapid oxidation of magnesium when heated to its melting point in air becomes important in welding. To prevent oxidation, an inert gas is used to shield the metal during arcwelding, and a flux is used for gas welding.

In all magnesium alloys, the solidification range increases and the solidification point and shrinkage decrease with general increase in alloy content. Aluminum content up to 10 pct increases weldability because it tends to refine grain structure. Zinc content of more than 1 pct increases hot shortness which can result in weld cracking.

Calcium in concentrations of 0.10 to 0.16 pct tends to increase the solidification range and lower the solidification point appreciably in the FS alloy. For best results in welding pressure vessels and tanks, FSW alloy with a maximum of 0.04 pct calcium is suggested.

Alloy loss is negligible

The good strength of arc and gas welds in magnesium alloys is due to their fine grain size which averages about 0.001 in. Spot welds have slightly finer grain size than arc or gas welds.

Because of its low alloy content and consequent higher melting point and higher electrical and thermal conductivities, Dowmetal M requires more heat to fusion weld than other magnesium alloys. More grain growth in the area next to the weld means that the weld joint efficiency of this alloy is lower than those of alloys of higher alloy content.

Failure of welded joints commonly occurs in the heat-affected zone rather than in the weld metal itself. This failure may occur because of slight grain growth in the base metal caused by the weld thermal cycle. In some cases it may occur because of an overaging or annealing effect outside the fused weld zone.

A homogeneous mixture of base metal and filler metal usually results from weld metal depositions. Loss in alloying elements due to either vaporization or diffusion is negligible.

A welding rod metal whose melting point is

"Arcwelding, using helium or argon to shield the molten metal is an efficient means of joining cast and wrought magnesium alloys. . . ."

lower than that of the metal to be welded can be used to advantage from the standpoint of handling characteristics or whenever cracking occurs. Slightly higher weld strengths are possible when higher alloy content rod is used, but toughness and ductility may be lower.

Arcwelding provides an efficient means of joining both cast and wrought magnesium alloys. An inert gas, such as helium or argon, shields the molten metal during welding. Gas is confined to the welding area by a cup around a tungsten electrode. Direct current reverse polarity, and alternating current with superimposed high-frequency current for arc stabilization are commonly used.

Ac and dc welds don't differ

Butt and fillet joints are preferred in magnesium. Lap welds are sometimes used, but joints of this type generally are unsatisfactory as butt joints for stressed applications.

The minimum thickness of magnesium for arcwelding is roughly about 0.040 in. with a backup. There is no known maximum thickness since the thickest plate in commercial use is being arcwelded. Design of a joint and skill of the welding operator usually determine the practical minimum and maximum thicknesses that can be arcwelded.

The tensile strengths of arcwelds usually run more than 90 pct of the strength of the annealed parent metal, except in the case of the moderate-strength Dowmetal M where joint efficiencies average about 60 pct. Because of the annealing effect of welding, hard-rolled magnesium sheet has lower weld joint efficiencies than annealed sheet averaging 60 to 80 pct. No appreciable difference exists in properties of welds made with alternating and direct current.

Choice of gas depends on area

When two magnesium alloys of different composition are arcwelded, the joint strength obtained is about equal to that of the alloy with the lower weld strength. Some improvement in weld strengths can be obtained by the use of higher alloy content welding rod, particularly where weld beads are ground flush. However, ductility may be reduced.

Normal atmospheric exposure results in no accelerated corrosive attack on arcwelds in magnesium. Tungsten inclusions which may occur in the weld do not affect corrosion resistance or weld properties. Because of the extreme hardness of such inclusions, high-speed machining or shearing of arcwelds can result in damaged tools.

Direct-current machines of the stable-arc type with continuous amperage control, and alternating-current machines with a high-frequency current superimposed for stabilization on the normal

welding current, are used on magnesium. The alternating-current machines are preferred because of better penetrating power, smaller beads and less distortion.

With alternating current, beveling is usually required to make single-pass butt welds in magnesium plate over $\frac{1}{2}$ in. thick, although successful welds have been made without beveling. It is desirable that alternating-current machines be equipped with a primary contactor which can be operated by a control switch on the torch or by a foot switch for starting and stopping the arc.

Direct current welding machines should be equipped with a continuous amperage control in the low ranges to obtain the fine current adjustments needed. Only reverse polarity, electrode positive, is practical since straight polarity is difficult to handle.

A third type of arcwelding equipment now being used on magnesium is the inert-gas-shielded metal-arc direct-current machine (electrode positive) with very high current density and which utilizes a consumable electrode of magnesium wire.

The inert gases, helium and argon, are both suitable for welding magnesium. Choice of gas depends largely on price and availability in a given area. Helium is considered more practical than argon for use with direct current.

Chemical cleaning preferred

With alternating current, helium seems to result in better penetration. However, as much as two to three times more helium by volume than argon is required for a given amount of welding, and argon is most frequently used with alternating current. Mixtures of argon and helium have been tried to reduce shielding-gas costs.

Magnesium alloys are usually supplied with an oil coating or chrome pickle finish for surface protection during shipment and storage. Oil-finished surfaces are preferred for materials to be welded since they are easier to clean. Where structures will be too large for immersion in chemical treatment tanks, and where such structures are to be painted after welding, chrome pickled metal should be used.

Chemical cleaning is preferred to mechanical cleaning for most production preweld cleaning because of the faster and better results obtained. Chemical cleaning gives longer protection time and more uniform cleaning as well as lower surface resistance. Parts are degreased and hot alkaline cleaned before being immersed for about 3 min in a bath of the following composition:

Chromic acid	24 oz
Sodium nitrate	4 oz
Water	to make 1 gal

The bath is operated at 70° to 90°F and is followed by thorough hot-water rinsing and air drying. Mechanical cleaning utilizes steel wool, aluminum-oxide abrasive cloth or power wire brush.

Welding rod should also be cleaned although cleaning may not be necessary in all cases. Straight rod can be cleaned with steel wool or the chromic acid sodium nitrate dip, and the coiled rod by the latter method only.

Edges to be welded should be smooth and free from loose pieces or pits which might contain any contamination such as oil or oxidation products. Milled, sawed, routed, sanded, or filed edges are satisfactory. Sheared edges are satisfactory for thin-gage sheet stock up to about 0.080 in. Thicker gages should be double-sheared which consists of a shaving operation to produce final dimensions and a smooth surface on the second shear cut.

Less preparation for ac welding

Less preparation is generally required for welding with alternating current than for welding with direct current because of the greater penetration obtained. A slight reverse bevel or chamfer is sometimes used on the edges of square butt joints to avoid a thin, dark oxide line of the weld bead drop-down, but is not required for sound welds.

Flanged edges are not commonly used because of the inability to make sharp bends on magnesium sheet without the use of heat. Double-beveled joints are usually more desirable than single-beveled joints from the standpoint of distortion.

As with other metals, fitup of parts should be as close as possible without any gaps at abutting edges, or with a gap of less than 1/16 in. Tack welds should range in size and spacing from 1/16-in. tacks on 1 or 2-in. centers in 0.064-in. sheet to about 1/4-in. tacks on 4 or 5-in. centers in 1/4-in. plate.

To prevent pulling apart the seam, tack welds should start a short distance from the end of the seam. Straightening during and after tacking can be accomplished by hammering with a soft leather or wood mallet.

Jigs needed for thin sheet

Welding jigs are necessary for most production work especially when welding thin sheet material. Due to the high thermal conductivity and thermal expansion coefficient of magnesium alloys, jigs must be very rigid to resist any movement of parts during welding.

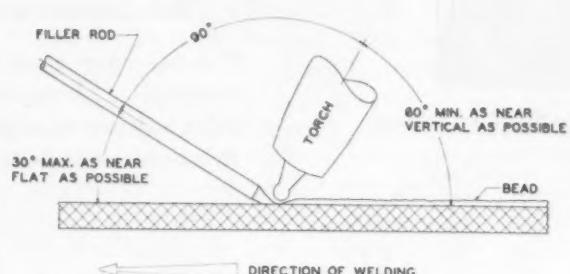
Use of a backing plate prevents excessive metal drop-down, holds material in line and, by maintaining equal reinforcement on weld bead drop-down and the top of the weld bead, minimizes distortion. It can also be used for straightening and stress relieving.

When welding with alternating current, the end of the electrode can be held almost flush or slightly below the surface of the work to get

maximum penetration. No fouling of the tungsten with magnesium will occur. The torch should be held with the electrode nearly perpendicular to the work, and the welding rod added from a position as nearly parallel with the weld surface as practical.

Welding should progress in a straight line at a uniform speed so that an even bead is deposited. A weaving or rotary motion is not recommended except for large corner joints or fillet welds. Forehand welding is most satisfactory. Welding rod can be fed either continuously or intermittently.

Should cracking be encountered during welding of certain alloys, starting and stopping plates may be used. Some welders have found that cracking may also be minimized by preheating the plate and jig to 200° to 400°F. This also reduces warpage and residual stresses in the welds. An increase in welding speed sometimes overcomes cracking.



WELD PROGRESSES in straight line at uniform speed if proper technique is used on magnesium alloys. Torch should be nearly perpendicular and filler rod nearly flat to work surface.



INERT GAS shields weld zone from atmospheric contamination as weld is made in magnesium by tungsten-arc method. Jig limits distortion in magnesium which expands much when heated.

No flux penetration—

FORCE FIT

Improves Brazed Aluminum Joints



By Bruce E. Brennan

Supervisor
Engineering Data
Reynolds Metals Co.
Louisville

- ◆ New technique of joining aluminum tubes combines force fitting and brazing . . . After squaring tube ends, female element is flared and swaged to an inside diameter 0.010 in. less than outside diameter of male element . . . Both elements are then force fitted and brazed.
- ◆ Joints have great strength, insure against flux penetration and resist corrosion . . . Tests show joints to be tight under pressures up to 850 psi . . . Joint is simple to make and adaptable to production line manufacturing . . . It is particularly valuable to heat exchanger industries.

◆ HEAT EXCHANGER INDUSTRIES—refrigeration, air conditioning, and many other cooling or heating coil users—now have a new method for joining aluminum tubes. The new technique, developed by Reynolds Metals Co., combines a force fit joint with a seal of brazed filler metal. The resulting joint has great strength, insures against flux penetration, and is highly resistant to corrosion. Joints are simple to make and are of consistently high quality.

One problem in brazing aluminum tubing has been the tendency of brazing flux to penetrate the joint and deposit on the inside of the tube. In many cases, it was not practical to remove flux which penetrated the joint. Very often, flux removal procedures could not be relied on and residues would be discovered when the equipment failed prematurely. Elimination of all flux penetration in brazed tube joints has been the primary object of research and development work in tube joining.

The new technique is a six-step operation. First, the tube ends are cut off square without distorting the tube shape. After the female element is flared and the male element deburred, the female element is swaged to an inside diameter about 0.010 in. less than the outside diameter of the male element. The two elements are force fitted together to the full depth of the swaged section. The relatively low modulus of elasticity of aluminum permits expansion of the small inside diameter of the female element.

Flux is applied around the flare and the joint completed by brazing.

Swaging and flaring the female element can be done easily in one step by using a special tool. Adaptation of such a tool to production line work offers no difficulties.

The force fit operation can be performed satisfactorily by large tong-like tools which grip the tube in each jaw and eliminate slipping. Application of straight-line pressure, while maintaining alignment of the tubes, is absolutely essential. Adaptation of a bolt-cutter type tool would provide all the necessary features. Ordinary large pliers are unsatisfactory because the jaws move through an arc.

Swaging can be done conveniently by clamping the female tube in one side and the swaging tool in the other, then advancing the swage into the tube by closing the tongs. To insure adequate strength, depth of the swaged section should be equal to the outside diameter of the tube, but not less than $\frac{1}{2}$ in. This depth is adequate for all applications.

Development of this tube-joining technique hinged on the penetration characteristics of the brazing flux. Brazing flux will not flow through clearances of 0.002 in. or less. An investigation of various joining methods showed that the force fit technique was most feasible for very tight joints because it completely prevented flux from flowing between the two tube walls.

To determine the tightness of the joint before

and after brazing, three different testing procedures were employed. After force fitting the pieces and prior to brazing, the assembly was submerged in water and subjected to internal air pressure. The joint remained tight up to 850 psi pressure and at 900 psi internal pressure the joints came apart. For such a simple joining technique, this performance was exceptionally good.

Penetrants, capable of exposing cracks and fissures not visible under a 10-power microscope were also applied to the force-fitted but unbrazed joint. Inspection after 60 min showed that no penetrant had passed through the joint. This indicated that no clearance existed between the male and female elements of the joint.

In a third test, a number of force-fitted and brazed specimens were sectioned and checked for flux penetration. Depth of flux penetration was determined by application of chemical solutions, such as silver nitrate, which are sensitive of even slight traces of flux. Maximum flux penetration by this test was approximately $\frac{1}{8}$ in.

After establishing the joint's resistance to flux penetration, tests approximating service exposures and conditions were started. Of 150 sections prepared for testing, half were brazed with one type of filler metal and flux, and half with another. After brazing, each joint was immersed in boiling soapy water for 5 min, then

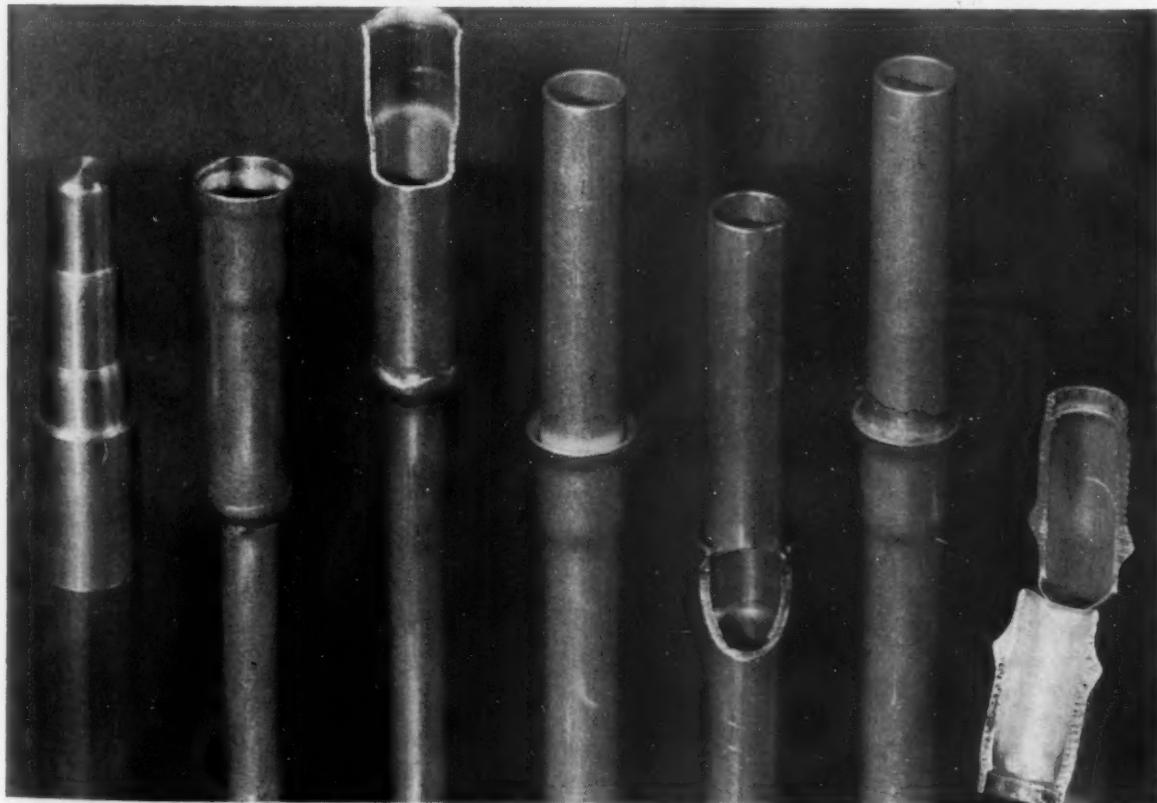
rinsed in a water bath at room temperature.

Each joint was charged with freon at 40 psi pressure, then increased to 200 psi by the addition of nitrogen. Pressurized sections were placed in a tank of clear water and checked for leaks at the brazed joint. Less than 1 pct were defective.

Tests were repeated for 2 weeks. Each day, following testing, the joints were returned to the clear water tank and removed the following morning and allowed to dry without acceleration. The freon and nitrogen pressure test was then repeated. No additional leaks were found after the first day's testing.

These same joints are now tested in salt spray and humidity cabinets in the laboratory. After 200 hours exposure, samples from the salt spray and humidity cabinet showed very little deterioration.

Initial work was based on a simple tight metal-to-metal contact achieved by telescoping two tubes together. The inside diameter of the female element was equal to the outside diameter of the male element. This joint was tight enough, without brazing, to hold 5 to 20 psi of air pressure. Most important, it was proof against flux penetration. By reducing the inside diameter of the flared tube, the joint successfully withstood an 850-psi air pressure. The joint is easily completed by torch, furnace or dip brazing. Return bends on heat exchangers are particularly adaptable to dip brazing.



FORCE FITTING AND BRAZING of aluminum tubing by a new technique is a six-step procedure. On left, is swaging and flaring tool.

Other steps show simple procedures to get a neat, strong joint with no possibility of flux penetration or leakage.



INCONEL: Which Welding Process Fits Your Job?



By K. M. Spicer
Technical Service
International Nickel Co., Inc.
New York

- ♦ Mechanical properties of Inconel welds are inherently good regardless of welding process used . . . No aftertreatment is needed to retain or restore corrosion resistance . . . Several factors govern choice of process . . . Thorough cleaning prior to welding prevents embrittlement due to lead, sulfur, phosphorus and other contaminants in shop materials.
- ♦ Tips for better welds include—use of shallow penetration and low heat input; avoid corner joints for high-temperature service; slight weaving helps; boron fluxes result in low ductility . . . In oxyacetylene welding, use cylinder acetylene since generated acetylene may contain sulfur . . . Pickup from melt or flux makes submerged-arc welding unsuitable for Inconel.

♦ INCONEL IS JOINED by the same welding processes applicable to steel, with or without slight modification. Choice of method is governed by (1) gage of metal to be joined, (2) design of the weldment, (3) joint design, (4) welding position, and (5) other considerations particular to the shop or job.

The minimum mechanical properties to be expected in Inconel when welded by the oxyacetylene, metal arc, inert gas tungsten-arc and inert gas consumable-electrode processes are given in the table.

Good properties are inherent in welded joints in Inconel, and no after-treatment is needed nor recommended to maintain or restore corrosion resistance. Thermal treatment may be applied to stress relieve a weldment to meet Code requirements.

Nickel, Inconel and other high-nickel alloys are susceptible to embrittlement at welding temperature by lead, sulfur, phosphorus and some low-melting metals and alloys. These, singly or in combination, are liable to be present in materials around the shop. Grease, oil, paint, marking crayons, machining lubricants, cutting oils and shop dirt are a few materials likely to cause trouble and should be completely removed prior to welding.

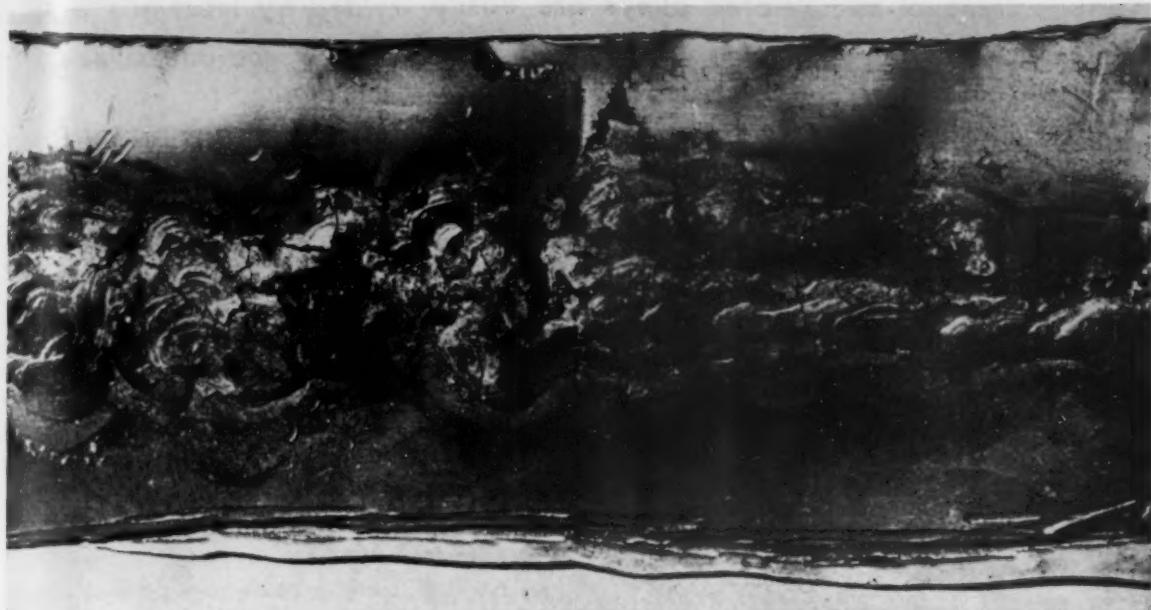
Remove skin before welding

When a joint is to be made between Inconel and a dissimilar metal or alloy that is oxidized, the oxide should be removed before welding starts. The rough surface, or "skin," of Inconel castings may contain sand (silica) which must also be removed from the areas to be welded. This can be done best by chipping, grinding or machining.

Many joint types are used in the fabrication of fusion welded equipment. Beveling is usually not required for material 0.109 in. thick or less, but thicker material should be beveled to form a V, U or J-groove. In addition to these, the designer has other types of joints from which to choose, all capable of carrying the calculated load.

Inconel weld metal does not spread as much as mild and low-alloy steel weld metal, nor do the appropriate electrodes give as deep penetration. If excessive heat input or puddling is used, serious loss of residual deoxidizers can be expected. Therefore, joint design must be such that normal heat input can be used in the welding operation.

Deep penetration and the attendant high heat input should be avoided. Proper accessibility can be provided by V joints beveled to an 80° included angle, and U joints beveled to a 15° side



EMBRITTLEMENT caused by sulfur and lead, often present in materials around the shop, ill-

lustrates why Inconel, nickel and high-nickel alloys should be cleaned thoroughly before welding.

angle and a 3/16-in. to 5/16-in. bottom radius.

Single bevels used to form T joints between dissimilar thicknesses should have an angle of 45°. The bottom radius of a J groove should be increased to a 3/8-in. minimum. Corner and lap joints may be used where high service stress will not be developed. However, butt joints are preferred since the stresses act axially rather than eccentrically.

Corner joints should also be avoided where the unit is to be subjected to high service temperatures. If corner joints cannot be avoided, a full-thickness weld should be made. This may require a fillet weld on the inner or root side of the joint.

Since weld metal does not spread as it does in welding steel, it must be placed where required by weaving the electrode slightly. The best electrode position for downhand metal arc welding is at an incline of about 20° from the vertical, ahead of the puddle. This position allows control over the molten flux and eliminates slag entrapment. A short arc is essential.

The only change necessary for overhead welding is a slight further shortening of the arc and lowering the current by 5 to 15 amp. Instructions for overhead welding also apply to vertical welding, except that amperage must be lowered 10 to

20 pct from that used for normal flat welding. For metal 0.062 in. to 0.093 in. thick, welding can be done either upward or downward. The electrode should be held approximately at a right angle to the plate.

When breaking the arc, it should first be shortened slightly and the rate of travel increased to reduce the puddle size. This reduces the possibility of crater oxidation, eliminates the rolled leading edge of the crater and provides an excellent condition for the restrike.

The rule of three should be observed in weaving the electrode. The weave should never be wider than three times the electrode diameter. Some violation of this rule is often necessary during vertical welding. Flatter beads are obtained by weaving, but the above rule should be followed even for overlays as wider weaves usually result in excessive puddling of the molten pool. Pronounced spatter indicates that the arc is too long, excessive amperage is being used, or the polarity is incorrect.

Welding slag formed by nickel and high-nickel electrodes is not normally detrimental to the service life of the weldment. However, good house-keeping calls for removal of all slag. Complete removal of slag from units intended for high-

AVERAGE MECHANICAL PROPERTIES OF INCONEL WELDS

Welding Process	Tensile Strength, psi	Yield Strength, 0.2 pct Offset	Weld Metal Elongation in 1/2-in., pct	Hardness, RB
Metal Arc	97,000	54,000	37	90
Oxyacetylene	85,500	34,000	40	81
Inert Gas Tungsten-Arc	94,750	45,000	40	84
Inert Gas Consumable-Electrode	85,125	37,200	50	83

"Inconel and related alloys are easily welded by inert-gas welding processes, producing welds which are sound, ductile and strong . . ."

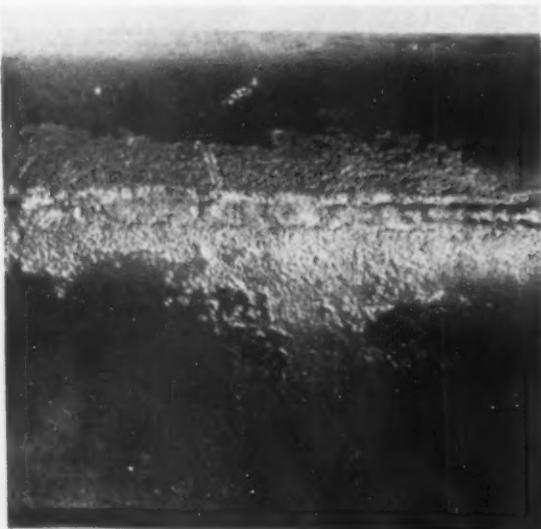
temperature service is mandatory since the molten slag is corrosive to nickel and chromium-bearing alloys.

There is no deleterious effect on the parent metal from the heat of arcwelding. The only effect is a very slight grain enlargement with softening in the heat-affected zone—a very narrow band at the edge of the weld. Neither ductility nor strength of the annealed parent metal is noticeably altered.

Inconel and related alloys are readily welded by the inert gas arcwelding processes. With proper control over the influencing factors, welds will be sound, ductile and strong. These processes are preferred for some types of fabrication, particularly where flux cannot be used for physical or chemical reasons. Either helium or argon may be used for inert gas tungsten arcwelding but helium usually produces a flatter bead than argon. Welding of small parts or thin materials is best done with argon due to the lower arc voltage and lower heat input.

Direct current, straight polarity is recommended for use with the manual or machine inert gas tungsten arcwelding process. Alternating current can be used for machine welding where close control of arc length is possible. Superimposed high-frequency current or 120-cycle equipment is required.

The procedure used in the tungsten arc process duplicates that generally used for stainless steel and other commonly used metals and alloys. It is important to avoid agitation of the weld metal or use of a filler wire diameter too large for the current density.



CORROSION on Inconel arcwelded pipe is due to the incomplete removal of slag. At normal temperatures, slag is usually not detrimental, but at 2100°F this 1/4-in. pipe corroded rapidly.

Arc length should be maintained at the shortest practical length. If a simple fusion weld, with no filler metal added, is required, the arc length should not exceed 0.050 in. This maximum arc length can be increased to about 0.10 in. when filler metal is added.

Inert gas metal arcwelding presents some problems not encountered in oxyacetylene welding. Wires produced for gas welding are unsuitable for making sound, pore-free inert gas metal-arc welds. Only wires especially developed for the inert gas arcwelding processes should be employed. These can be obtained in cut lengths or coils.

Borate-free flux best

Backing fluxes or gases may be used where a clean root surface is desired. When fluxes are used they should be of a chemical rather than a refractory nature. Fluxes containing boron form a brittle low-melting eutectic at the grain boundaries which results in a weld with low ductility. The flux recommended for gas welding of Inconel can also be used when required for inert gas-shielded arcwelding. Fused fluxes are removed easily by grit or sandblasting.

When welding Inconel with consumable electrode equipment, best results are obtained by balancing the wire speed and current density at a level just beyond the point where the metal transfer changes from visible droplets to spray form. Excessive amperage can result in too large a puddle and superheated weld metal with subsequent cracking, particularly in heavy sections.

The oxyacetylene flame is the only one of the many oxy-gas or air-gas flames having a temperature sufficiently high to satisfactorily gas weld Inconel and related high-nickel alloys. Generator acetylene is not recommended for gas welding of Inconel and other high-nickel alloys. The specification (Federal Spec. OC-101) to which calcium carbide is produced permits up to 0.5 pct sulfur. Enough can be carried in the gas to cause embrittlement of the base material. Clean, bottled acetylene should be used.

A slightly reducing (carburizing) oxyacetylene flame is recommended with just a little excess acetylene. Only a slight feather, no longer than 1/16 in. should show beyond the tip of the luminous cone. Too reducing a flame as this can result in carbon pickup in the Inconel weld. A soft flame is preferable to a harsh or wild flame such as occurs with a small tip.

Submerged-arc welding is not recommended for Inconel because undesirable chemical changes are caused by pickup of elements from the fused melt or flux. The metal arc or inert gas consumable-electrode processes are better suited for welding the heavier gages of Inconel.

Copper Arcwelding Electrodes

ASTM AWS Symbol	Air Reduction Sales Co.	Alloy Rods Co.	All-State Welding Alloys Co.	Ampco Metal, Inc.	Arcos Corp.	Canadian Liquid Air Co.	Champion Rivet Co.	General Electric Co.	Hobart Bros. Co.	Lincoln Electric Co.	Marquette Mfg. Co.	Metal & Thermit Corp.	National Cylinder Gas Co.	C.
E-Cu														
E-Cu Sn A	Airco 70			Phos-Trode				W-70				Murex Type PB-57	20B	Cru Arc
E-Cu Sn C		Bronze Arc	All-State No. 24			Bronze Arc	Bronze Devil		Arcbrenz	Aerisweld				Cru Arc
E-Cu Ni					Nicuend									
E-Cu Si											No. 61			
E-Cu Al A	Airco 100			Ampco-Trode 10								Murex Type AB-12		
E-Cu Al B	Airco 116			Ampco-Trode 160								Murex Type AB-16		
E-Cu Al C	Airco 120			Ampco-Trode 200								Murex Type AB-20		
E-Cu Al D	Airco 125			Ampco-Trode 250								Murex Type AB-25		
E-Cu Al E	Airco 130			Ampco-Trode 300								Murex Type AB-30		

Armor Plate Arcwelding Electrodes

U. S. Spec. No.	Air Reduction Sales Co.	Alloy Rods Co.	Arcos Corp.	Canadian Liquid Air Co.	Champion Rivet Co.	General Electric Co.	Harnischfeger Corp.	Lincoln Electric Co.	McKay Co.	Metal & Thermit Corp.	National Cylinder Gas Co.	Page Steel & Wire
WD-EL 307	Airco 19-8 Mn Lime Type	Armorarc C Lime ac-dc		Armorarc C (Lime ac-dc)	Champion 307 B-1	W-1307	AW-3C		Armorloy A-8	Armorweld 8 or 199 MnA	Armorod 1	Page Armor Welding Rod
WD-ET 307	Airco 19-9 Mn Titanium Type	Armorarc B (307 Lime)	Chromend 19-8 Mn	Armorarc B (Lime 307)	Champion 307 MN-2	W-2307	AW-3C-T				Armorod 2	Page Armor Welding Rod
WD-ET 308	Airco 19-9 Mo Titanium Type	Mn ac-dc		Armorarc MN-Titania	Champion 308 MO-2	W-2308	308 Mo-T		Armorloy A-9	Armorweld 9 or 199 MnA	Armorod 3	Page Armor Welding Rod
MIL-E-986 Grade 160	327		Tensilend 70N			W-716B	70LA-2	Shield-Arc LH-70 M	Pluralloy 70			
MIL-E-986 Grade 230	353	Weld Arc Type 10016 NM	Tensilend 100 ac-dc	Weld Arc 10016 NM	HY-LO-230-D	W-1016C	P & H 12		Pluralloy 100	HTS 230		Page PP-230
MIL-E-986 Grade 260	352	Weld Arc Type T2015 NMV	Tensilend 120 dc	Weld Arc 12015 NMV		W-1215A	P & H 17		Pluralloy 120	HTS 260		

Mild Steel Arcwelding Electrodes

ASTM-AWS Specification No.	Electrode Coating	Welding Position	Air Reduction Sales Co.	Alloy Rods Co.	All-State Welding Alloys Co.	American Agile Corp.	Arcos Corp.	Canadian Liquid Air Co.	Champion Füvet Co.	General Electric Co.	Harnischfeger Corp.	Hobart Bros. Co.	Lincoln Electric Co.	McKay Co.	Marquette Mfg. Co.	Metz Thru Corp.
E-4510	Sulcoated or Light Coated	F, V, OH, H	Airco 41, 63					SC 15	Processed Sulcoat	F, L	Washcote	Sulkote	Stable-Arc	McKay 21	No. 101	
E-4520	Sulcoated or Light Coated	H-Fillets, F						Type A	Speed #44					McKay 3		
E-6010	High Cellulose Sodium	F, V, OH, H	Airco 78E	Weld Arc Type 6010	Monoweld No. 1	Agile White		LA Type 6010	Blue Devil	W-610A	AP, APV	No. 10	Fleetweld 5, 51	McKay 15, 15-D	No. 105	Munro Type
E-6011	High Cellulose Potassium	F, V, OH, H	Airco 230	Weld Arc Type 6011	Monoweld No. 1	Agile Blue		LA Type 6011	Bluedar	W-611A	AC-1	No. 335	Fleetweld 35, 180	McKay 11	No. 130	Munro Type
E-6012	High Titania Sodium	F, V, OH, H	Airco 323 337	Weld Arc Type 6012	Monoweld No. 1	Agile Red-White		LA Type 6012	Gray Devil	W-612A	PF, PFA	No. 12, No. 77	Fleetweld 7, 72	McKay 17, 118	No. 120	Munro Geom. Geom.
E-6013	High Titania Potassium	F, V, OH, H	Airco 90, 90-A	Weld Arc Type 6013	No. 613	Agile Blue-Red, Brown		LA Type 6013	Gray dac	W-613A	AC-3, SM	No. 13, No. 313, No. 447	Fleetweld 37, 47	McKay 24	No. 151	Munro Alum. Type
E-6015	Low Hydrogen Sodium	F, V, OH, H				Agile FMS				70 LA-2			Pluralloy 70		No. 140, No. 6013	
E-6016	Low Hydrogen Potassium	F, V, OH, H	Airco 312	Weld Arc Type 7016	No. 616	Agile FMS-AC	Tensilend 70	HFA Weldarc 7016	Hy-Lo	W-616A	70 LA-2	No. 16 or 716	Shield-Arc LH70	AC Pluralloy 70		Munro Type
E-6020	High Iron Oxide	H-Fillets, F	Airco 308, 315	Weld Arc Type 6020	Monoweld No. 2	Agile Blue-Grey		LA Type 6020	Black Devil	W-620A	DH-2	No. 111	Fleetweld 11	McKay 16	No. 115	Munro Type
E-6030	High Iron Oxide	F			Monoweld No. 2	Agile White-Grey			Red Devil	W-620B				McKay 18		Munro Type

g Electrodes

Hobart Bros. Co.	Lincoln Electric Co.	Marquette Mfg. Co.	Metal & Thermit Corp.	National Cylinder Gas Co.	C. E. Phillips & Co.	Reid-Avery Co.	Weldwire Co., Inc.
			Murex Type PB-57	20B	Crucible Arc No. 85	Racolloy Phosphor Bronze	
ronz	Aerisweld				Crucible Arc No. 60		Weldbest 620-15 Weldbest 730-15 Weldbest 610-15 Weldbest Albronze 100 Weldbest Albronze 200
		No. 61	Murex Type AB-12 Murex Type AB-16 Murex Type AB-20 Murex Type AB-25 Murex Type AB-30				

ding Electrodes

Hobart Bros. Co.	McKay Co.	Metal & Thermit Corp.	National Cylinder Gas Co.	Page Steel & Wire	Reid-Avery Co.	A. O. Smith Corp.	Weldwire Co., Inc.	Westinghouse Electric Corp.
	Armorloy A-8	Armorweld 8 or 199 MnA	Armorod 1 Armorod 2 Mn Armorod 3 Mo	Page Armor Welding Rod Page Armor Welding Rod Page Armor Welding Rod	Racolloy 307 Racolloy 25-20	SW-164	Weldbest 307-15 Weldbest 307-16	Flexarc 307L Flexarc 307 TL Flexarc 308 Mo-A-TL
	Armorloy A-9	Armorweld 9 or 199 MoA						
ire M	Pluralloy 70 Pluralloy 100 Pluralloy 120	HTS 230 HTS 260		Page PF-230	Raco 230-15 Raco 260-15	SW-65 SW-100 ac-dc SW-120 dc	Weldbest 230-16 Weldbest 260-15	

ing Electrodes

Hobart Bros. Co.	Lincoln Electric Co.	McKay Co.	Marquette Mfg. Co.	Metal & Thermit Corp.	National Cylinder Gas Co.	Page Steel & Wire	Reid-Avery Co.	A. O. Smith Corp.	Steel Co. of Canada	Westinghouse Electric Corp.
alkete	Stable-Arc	McKay 21	No. 101		Type 30-S	Page B bare	Blue Label		Stelco Electrod No. 4 bare, No. 4 FCW	Sulcoat Grade 18
		McKay 3			Type 30-XL		D. M-9 Knurled			
lo. 10	Fleetweld 5, 51	McKay 15, 16-D	No. 105	Murex Type R	Sureweld B, BP	Raco 7	SW-10	Stelco Electrod No. 704, 704D	Flexarc AP	
lo. 335	Fleetweld 35, 180	McKay 11	No. 130	Murex Type A	Sureweld CB	Raco 11	SW-14	Stelco Electrod No. 504, 504D	Flexarc ACP	
lo. 12, No. 77	Fleetweld 7, 72	McKay 17, 116	No. 120	Murex Genex, Genex M	Sureweld N, NM, G	Raco 8	SW-11, SW-17	Stelco Electrod No. 604	Flexarc FP, FP-2	
lo. 13, No. 313, No. 447	Fleetweld 37, 47	McKay 24	No. 181 No. 140, No. 6013	Murex, Alternex, Type U	Sureweld CN	Raco 13A, 13B	SW-15, SW-16, SW-18	Stelco Electrod No. 404	Flexarc SW, SW-2	
lo. 16 or 716	Shield-Arc LH70	Pluralloy 70 AC Pluralloy 70		Murex Type HTS		Raco 180-15	SW-64, SW-65			
lo. 111	Fleetweld 11	McKay 16	No. 115	Murex Type FHP	Sureweld FD	Raco 180-16	SW-35	Stelco Electrod No. 804	Flexarc LOH-2	
		McKay 18		Murex Type D		Raco 20	SW-20, SW-25	Stelco Electrod No. 904	Flexarc DH	

The Iron Age

Welding Rod and Electrode Charts

Producers of Rods

For Carbon and Stainless Steels, Aluminum,
Copper, Nickel and Magnesium Alloys

(Numbers indicate producing companies. See key on next page.)

	Gas	Carbon Arc	Atomic Hydrogen	Inert-Gas Tungsten-Arc	Inert-Gas Metal-Arc	Submerged Arc	Braze Welding
ASTM Spec.							
A7	1,16,17,18,23	1,17,18,23	1,18,23	1,18,23	1,18,22,23	14,16,18,22,23	1,4,19,20,23
A53	1,16,17,18,23	1,18,23	1,18,23	1,18,23	1,18,23	14,16,18,23	1,4,19,20,23
A129	1,16,17,18,23	1,18,23	1,18,23	1,18,23	1,18,23	14,16,18,23	1,4,19,20,23
A131	1,16,17,18,23	1,18,23	1,18,23	1,18,23	1,18,23	14,16,18,23	1,4,19,20,23
A201	1,16,17,18,23	1,18,23	1,18,23	1,18,23	1,18,23	14,16,18,23	1,4,19,20,23
A202	1,18,23	1,18,23	1,18,23	1,18,23	1,18,23	14,18,23	1,4,19,23
A203	1,17,18,23	1,18,23	1,18,23	1,18,23	1,18,22,23	18,22,23	1,4,19,20,23
A204	1,17,18,23	1,18,23	1,18,23	1,18,23	1,18,22,23	14,18,22,23	1,4,19,23
A212	1,18,23	1,18,23	1,18,23	1,18,23	1,18,22,23	14,16,18,22,23	1,4,19,20,23
A225	1,18,23	1,18,23	1,18,23	1,18,23	1,18,22,23	14,18,22,23	1,4,19,23
A283	1,17,18,23	1,18,23	1,18,23	1,18,23	1,18,22,23	14,18,22,23	1,4,19,20,23
A285	1,17,18,23	1,18,23	1,18,23	1,18,23	1,18,22,23	14,18,22,23	1,19,20,23
AISI Types							
Stainless Steels—Austenitic							
301	1,2,3,10,18,23	10,18,23	1,10,18,23	1,8,10,18,23	1,8,10,18,23	8,10,18,23	1,4
302	1,2,10,18,23	10,18,23	1,10,18,23	1,8,10,18,23	1,3,8,10,18,23	3,8,10,18,23	1,4
302B	1,2,10,23	10,23	1,10,23	1,10,23	1,10,23	10,23	1
303	1,2,23	23	1,23	1,23	1,23	23	1
304	1,2,3,10,18,22,	10,18,22,23	1,10,18,22,23	1,8,10,15,18,	1,3,8,10,15,18,	3,8,10,14,15,	1,4
	23			22,23	22,23	18,22,23	
308	1,2,3,10,18,22,	10,18,22,23	1,10,18,22,23	1,8,10,15,18,	1,3,8,10,11,15,	3,8,10,14,15,	1,4
	23			22,23	22,23	18,22,23	
309	1,2,3,10,18,22,	10,18,22,23	1,10,18,22,23	1,8,10,15,18,	1,3,8,10,11,15,	3,8,10,15,18,	1,4
	23			22,23	22,23	18,22,23	
309S	1,2,10,23	10,23	1,10,23	1,8,10,23	1,8,10,23	8,10,23	1
310	1,2,3,10,18,22,	10,18,22,23	1,10,18,22,23	1,8,10,15,18,	1,3,8,10,11,15,	3,8,10,15,18,	1,4
	23			22,23	22,23	18,22,23	
318	1,2,3,10,18,22,	10,18,22,23	1,10,18,22,23	1,8,10,15,18,	1,3,8,10,11,15,	3,8,10,15,18,	1,4
	23			22,23	22,23	18,22,23	
317	2,3,10,22,23	10,22,23	10,22,23	10,22,23	10,22,23	3,10,22,23	
321	1,2,3,10,22,23	10,22,23	1,10,22,23	1,8,10,15,22,23	1,3,8,10,11,18,	3,8,10,15,22,23	1,4
347	1,2,3,10,18,22,	10,18,22,23	1,10,18,22,23	1,8,10,15,18,	1,3,8,10,11,18,	3,8,10,15,18,	1,4
	23			22,23	22,23	18,22,23	
Stainless Steels—Martensitic							
403	2,10,22,23	10,22,23	10,22,23	8,10,22,23	1,8,10,22,23	8,10,22,23	
410	2,3,10,18,22,23	10,18,22,23	10,18,22,23	8,10,15,18,22,	1,3,8,10,15,18,	3,8,10,15,18,	4
420	2,3,10,18,22,23	10,18,22,23	10,18,22,23	8,10,15,18,22,	1,3,8,10,15,18,	3,8,10,15,18,	4
501	2,10,18,22,23	10,18,22,23	10,18,22,23	10,18,22,23	10,18,22,23	10,18,22,23	
502	2,8,10,18,22,23	10,18,22,23	10,18,22,23	8,10,15,18,22,	1,8,10,15,18,22,	8,10,15,18,22,	

(Chart continued on next page)

Producers of Rods (Continued)

	Gas	Carbon Arc	Atomic Hydrogen	Inert-Gas Tungsten-Arc	Inert-Gas Metal-Arc	Submerged Arc	Braze Welding
Stainless Steels—Ferritic							
405	2, 10, 22, 23	10, 22, 23	10, 22, 23	10, 22, 23	10, 22, 23	10, 22, 23	
430	2, 3, 10, 15, 22, 23	10, 10, 22, 23	10, 10, 22, 23	8, 10, 15, 18, 22, 23	1, 3, 6, 10, 15, 18, 22, 23	3, 6, 10, 15, 18, 22, 23	4
442	2, 22, 23	22, 23	22, 23	8, 22, 23	8, 22, 23	8, 22, 23	
446	2, 3, 10, 22, 23	10, 22, 23	10, 22, 23	8, 10, 15, 22, 23	1, 3, 6, 10, 15, 22, 23	3, 6, 10, 15, 22, 23	
Commercial Designation							
Aluminum Alloys							
25	1, 4, 5, 10, 17, 22, 23	1, 5, 22, 23	1, 4, 5, 10, 22, 23	1, 4, 5, 10, 17, 22, 23	1, 4, 11, 10, 22, 23		4
35	1, 4, 5, 17, 23	1, 5, 22, 23	1, 4, 5, 22, 23	1, 4, 5, 17, 22, 23	1, 4, 22, 23		4
45	1, 4, 5, 17, 22, 23	1, 4, 5, 22, 23	1, 4, 5, 22, 23	1, 4, 5, 17, 22, 23	1, 4, 22, 23		4
435	1, 4, 10, 17, 22, 23	1, 4, 22, 23	1, 4, 10, 22, 23	1, 4, 10, 17, 22, 23	1, 4, 11, 10, 22, 23		4
625	1, 4, 5, 17, 22, 23	1, 4, 5, 22, 23	1, 4, 5, 22, 23	1, 4, 5, 17, 22, 23	1, 4, 5, 22, 23		4
535	1, 4, 5, 17, 22, 23	1, 4, 5, 22, 23	1, 4, 5, 22, 23	1, 4, 5, 17, 22, 23	1, 4, 5, 22, 23		4.5
615	1, 4, 5, 17, 22, 23	1, 4, 5, 22, 23	1, 4, 5, 22, 23	1, 4, 5, 17, 22, 23	1, 4, 5, 22, 23		4.5
635	1, 4, 5, 17, 22, 23	1, 4, 5, 22, 23	1, 4, 5, 22, 23	1, 4, 5, 17, 22, 23	1, 4, 5, 22, 23		4.5
785	17			17			
ASTM Designation							
Magnesium Alloys							
M1	5, 9	5	5	5, 9	9		4.9
AZ31X	5	5	5	5, 9	1, 9		4
AZ61X	5	5	5	5, 9	1, 9		4
AZ83	5	5	5	5, 9	1, 9		4
AZ80X	5	5	5	5, 9	1, 9		4
AZ92	5	5	5	5, 9	1, 9		4
Types							
Copper Alloys							
Deoxidized copper	1, 4, 6, 10, 22, 23	1, 10, 22, 23	1, 22, 23	1, 6, 19, 22, 23	1, 6, 7, 22, 23	7, 19, 22, 23	1, 4, 6, 10, 20
Low brasses	1, 4, 10, 23	10, 23	23	1, 10, 23	1, 7	7	1, 4, 20
High brasses	1, 4, 6, 10, 19, 23	7, 10, 23	7, 23	1, 7, 10, 23	1, 7	7	1, 4, 6, 20
Silicon bronze	4, 6, 10, 22, 23	6, 10, 22, 23	22, 23	6, 7, 10, 22, 23	6, 6, 7, 22, 23	7, 19, 22, 23	1, 20
Phosphor bronze	4, 22	6, 21, 22	22	6, 22	6, 6, 7, 22	7, 22	1, 4, 20
Aluminum bronze	22	7, 22	7, 22	6, 6, 7, 22	6, 6, 7, 22, 23	7, 22, 23	4, 20
Cupro-nickel	4, 6, 22	22	22	7, 6, 22	7, 6, 8, 22	7, 6, 22	4, 20
Beryllium copper				7	7	7	4
Nickel Alloys							
Nickel	13, 22	22	13, 22	6, 13, 22	1, 8, 13, 22	8, 13, 22	4, 20
"L" Nickel	13, 22	22	13, 22	13, 22	13, 22	13, 22	
"D" Nickel	13, 22	22	13, 22	22	22	22	
"Z" Nickel	22	22	22	22	22	22	
Monel	13, 22	22	13, 22	8, 13, 22	1, 8, 13, 22	8, 13, 22	4, 20
"K" Monel	13, 22	22	13, 22	13, 22	13, 22	22	
"KR" Monel	13		13	13	13		
Ni-Cr Alloys				8	8	8	
Inconel	13, 22	22	13, 22	6, 13, 22	1, 8, 13, 22	8, 22	4
Inconel "X"		22	13, 22	13, 22	13, 22	22	
Hastelloy B	12, 23			12, 23	12, 23	12, 23	
Hastelloy C	12, 23			12, 23	12, 23	12, 23	
Hastelloy D	12, 23						

Availability of rods from manufacturers listed in these tables does not necessarily imply that these rods will meet every welding condition and service requirement. Because results may differ from job to job, the manufacturer should be consulted before making a rod selection.

Rod and Electrode Manufacturers

(Numbers are key to rod producers)

- 1 Air Reduction Sales Co., 40 E. 42nd St., New York 17, N. Y.
- 2 Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh 22, Pa.
- 3 Alloy Metal Wire Co., Inc., Prospect Park, Pa.
Alloy Rods Co., York, Pa.
- 4 All-State Welding Alloys Co., 249-55 Ferris Ave., White Plains, N. Y.
- 5 Aluminum Co. of America, Pittsburgh 19, Pa.
American Agile Corp., 5806 Hough Ave., Cleveland 13, Ohio
- 6 American Brass Co., Waterbury 20, Conn.
- 7 Ampco Metal, Inc., 1745 S. 30th St., Milwaukee 46, Wis.
- 8 Arcos Corp., 1500 S. 50th St., Philadelphia 43, Pa.
Canadian Liquid Air Co., Ltd., 1111 Beaver Hall Hill, Montreal, Can.
- 9 Champion Rivet Co., Harvard Ave. & E. 109th St., Cleveland, Ohio
- 10 Drawalloy Corp., Lincoln Hwy. W. & Alloy St., York, Pa.
- 11 General Electric Co., 1 River Road, Schenectady 5, N. Y.
Harnischfeger Corp., 4400 W. National Ave., Milwaukee 46, Wis.
- 12 Haynes Stellite Co., Kokomo, Ind.
Hobart Bros. Co., Hobart Square, Troy, Ohio
- 13 International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.
- 14 Lincoln Electric Co., 22801 St. Clair Ave., Cleveland 17, Ohio
Linde Air Products Co. (23)
- 15 Marquette Mfg. Co., Inc., 307 E. Hennepin Ave., Minneapolis 14, Minn.
- 16 Maurath, Inc., Warrensville Sta., Cleveland, Ohio
- 17 McKay Co., York, Pa.
- 18 Metal & Thermit Corp., 100 E. 42nd St., New York 17, N. Y.
- 19 National Cylinder Gas Co., 840 N. Michigan Ave., Chicago 11, Ill.
- 20 Page Steel & Wire Div., American Chain & Cable Co., Inc., Monessen, Pa.
C. E. Phillips & Co., 2750 Poplar St., Detroit 8, Mich.
Reid-Avery Corp., Dundalk, Baltimore 22, Md.
- 21 Revere Copper & Brass, Inc., Rome, N. Y.
- 22 Scovill Mfg. Co., 100 Mill St., Waterbury, Conn.
- 23 Seymour Mfg. Co., Seymour, Conn.
A. O. Smith Corp., Milwaukee 1, Wis.
- 24 Steel Co. of Canada, Ltd., P. O. Box 460, Montreal, Can.
- 25 Weldwire Co., Inc., Emerald & Hagert Sts., Philadelphia 25, Pa.
Westinghouse Electric Corp., Trafford, Pa.
- 26 Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

The Iron Age

welding rod and electrode charts (continued)

Corrosion Resisting Steel

ASTM-AWS Specifications No.	Current	Air Reduction Sales Co.	Alloy Rods Co.	All-State Welding Alloys Co.	Arcos Corp.	Canadian Liquid Air Co.	Champion Rivet Co.	General Electric Co.	Harnischfeger Corp.	Hobart Bros. Co.	L Ele
E-306-15	dc.....	Airco 19-8 Lime	Arcaloy 308 Lime	All-State 18-8	Chromend K	Arcaloy 308 Lime	308-1	W-1308	Harstain 18-8	No. 308	Stair A5
E-308-16	ac or dc ..	Airco 19-9 Titania	Arcaloy 308 ac-dc	All-State 299	Stainlend K	Arcaloy 308 Titania	308-2	W-2308	Harstain A 18-8	No. 308	Stair A7
E-309-15	dc.....	Airco 25-12 Lime	Arcaloy 309 Lime	All-State 299	Chromend HC	Arcaloy 309 Lime	309-1	W-1300	Harstain 25-12	No. 309	Stair B-C
E-309-18	ac or dc ..	Airco 25-12 Titania	Arcaloy 309 ac-dc	All-State 299	Stainlend HC	Arcaloy 309 Titania	309-2	W-2309	Harstain A 25-12	No. 309	.....
E-310-15	dc.....	Airco 25-20 Lime	Arcaloy 310 Lime	All-State 299	Chromend HCN	Arcaloy 310 Lime	310-1	W-1310	Harstain 25-20	No. 310	Stair D
E-310-16	ac or dc ..	Airco 25-20 Titania	Arcaloy 310 ac-dc	All-State 292	Stainlend HCN	Arcaloy 310 Titania	310-2	W-2310	Harstain A 25-20	No. 310	.....
E-316-15	dc.....	Airco 18-12 Mo Lime	Arcaloy 316 Lime	All-State 299	Chromend K Mo	Arcaloy 316 Lime	316-1	W-1316	Harstain 18-8 Mo	No. 316	Stair C-C
E-316-16	ac or dc ..	Airco 18-12 Mo Titania	Arcaloy 316 ac-dc	All-State 299	Stainlend K Mo	Arcaloy 316 Titania	316-2	W-2316	Harstain 18-8 Mo	No. 316	.....
E-317-15	dc.....	Airco 18-12 3.5 Mo Lime	Arcaloy 317 Lime	All-State 299	Chromend 18-8 Mo	Arcaloy 317 Lime	317-1	W-1317	Harstain 18-8-3 Mo	.....	.....
E-317-16	ac or dc ..	Airco 18-12 3.5 Mo Titania	Arcaloy 317 ac-dc	All-State 299	Stainlend 18-8 Mo	Arcaloy 317 Titania	317-2	W-2317	Harstain A 18-8-3 Mo	.....	.....
E-330-15	dc.....	Airco 35N 15 Cr Lime	Arcaloy 330 Lime	All-State 15-35	Chromend 15-35	Arcaloy 330 Lime	330-1	W-1330	.....	.....	.....
E-330-16	ac or dc ..	Airco 35N 15 Cr Titania	Arcaloy 330 ac-dc	All-State 15-35	.....	Arcaloy 330 Titania	330-2	W-2330	.....	.....	.....
E-347-15	dc.....	Airco 19-9 Cb Lime	Arcaloy 347 Lime	All-State 19-9 Cb	Chromend 19-9 Cb	Arcaloy 347 Lime	347-1	W-1347	Harstain 18-8 Cb	No. 347	Stair A5
E-347-16	ac or dc ..	Airco 18-9 Cb Titania	Arcaloy 347 ac or dc	All-State 19-9 Cb	Stainlend 19-9 Cb	Arcaloy 347 Titania	347-2	W-2347	Harstain A 18-8 Cb	No. 347	Stair A7
E-410-15	dc.....	Airco 12 Lime	Arcaloy 410 Lime	All-State 12	Chromend 12	Arcaloy 410 Lime	410-1	W-1410	.....	.....	.....
E-410-16	ac or dc ..	.....	Arcaloy 410 ac-dc	All-State 12	.....	Arcaloy 410 Titania	410-2	.....	.....	.....	.....
E-430-15	dc.....	Airco 16 Cr Lime	Arcaloy 430 Lime	All-State 18	Chromend 18	Arcaloy 430 Lime	430-1	W-1430	.....	.....	.....
E-430-16	ac or dc ..	.....	Arcaloy 430 ac or dc	All-State 18	.....	Arcaloy 430 Titania	430-2	.....	.....	.....	.....
E-502-15	dc.....	Airco 4-6 Cr Mo Lime	Arcaloy 502 Lime	All-State 5M	Chromend 5M	Arcaloy 502 Lime	502-1	W-1502	Harchrome 5 Cr	.....	.....
E-502-16	ac or dc ..	.....	Arcaloy 502 ac-dc	All-State 5M	.....	Arcaloy 502 Titania	502-2	.....	.....	.....	.....

Low Alloy Steel A

ASTM-AWS Specification No.	Electrode Coating	Welding Position	Air Reduction Sales Co.	Alloy Rods Co.	All-State Welding Alloys Co.	Arcos Corp.	Canadian Liquid Air Co.	Champion Rivet Co.	General Electric Co.	Harnis Co
E-7010	High Cellulose Sodium	F, V, OH, H	Airco 93	Weld Arc Type 7010	.....	.....	LA Type 7010	Blue Devil 85	W-710A	CM-50
E-7011	High Cellulose Potassium	F, V, OH, H	Airco 382	Weld Arc Type 7011	.....	.....	.....	.....	W-711A	CM-50
E-7015	Low Hydrogen Sodium	F, V, OH, H	.....	Weld Arc Type 7016 & Type 7016N	No. 616	Tensilend 70, 70N	HFA Weldarc 7016 Weldarc 7016N	Hy-Lo	W-716B	70-LA-
E-7016	Low Hydrogen Potassium	F, V, OH, H	Airco 327	Weld Arc Type 7020	.....	.....	LA Type 7020	Black Devil 75	W-720A	CM-50
E-7020	High Iron Oxide	H-Fillets, F	Airco 94	.....	.....	.....	.....	.....	.....	75-LP, 80-LE
E-8015	Low Hydrogen Sodium	F, V, OH, H	.....	Weld Arc Type 8016N	.....	Chromend 1M Nickend 2	Weldarc 8016N	.....	W-816A	.....
E-8016	Low Hydrogen Potassium	F, V, OH, H	Airco 396	.....	.....	.....	.....	.....	.....	90-LE, AW-2
E-9015	Low Hydrogen Sodium	F, V, OH, H	.....	Weld Arc Type 9016CM	.....	Manganend 1M	Weldarc 9016CM	.....	W-916A	P & H
E-9016	Low Hydrogen Potassium	F, V, OH, H	.....	Type 9016MM	.....	Manganend 2M	Weldarc 9016MN	.....	W-1013A	AW-4
E-10013	High Titania Potassium	F, V, OH, H	.....	Type 9016NCM	.....	Chromend 2M	Weldarc 9016NCM	Chromoly 10013	W-1013A	AW-4
E-10015	Low Hydrogen Sodium	F, V, OH, H	.....	Weld Arc Type 10016CM	.....	.....	.....	Hy-Lo 230-D	W-1016A	90-LH-
E-10016	Low Hydrogen Potassium	F, V, OH, H	Airco 394, 351	Type 10016NM	.....	Manganend 2M	Weldarc 10016CM	.....	W-1016B	P & H
E-12015	Low Hydrogen Sodium	F, V, OH, H	Airco 352	Weld Arc Type 12015NMV	.....	Tensilend 100	Weldarc 10016NM	.....	W-1215A	P & H
						Tensilend 120	Weldarc 12015 NMV	.....	

Aluminum Arcwelding Electrodes

AISI-AWS Specification No.	Air Reduction Sales Co.	All-State Welding Alloys Co.	American Agile Corp.	Canadian Liquid Air Co.	Champion Rivet Co.	Hobart Bros. Co.	Lincoln Electric Co.	Marquette Mfg. Co.	Metal & Thermit Corp.	National Cylinder Gas Co.	Weldwire Co., Inc.
AI-2		All-State No. 30								AL-2	
AI-43	Airco 57	All-State No. 32	Agile Aluminum 5 Pct Si	LA Aluminum	Type E-43	Hobart Aluminum	Aluminweld	No. 70	AL-43	Sureweld 1217-C	Weldbest 43S-AI

Aluminum Arcwelding Electrodes

incoln etric Co.	The McKay Co.	Marquette Mfg. Co.	Metal & Thermit Corp.	Maurath Inc.	National Cylinder Gas Co.	Page Steel & Wire	Reid-Avery Corp.	A. O. Smith Corp.	Weldwire Co., Inc.	Westinghouse Electric Corp.
rweld	McKay 18-8 dc Lime		Murex 19-9	Maurath 18-8-S dc, Lime	Sureweld 308	Page-Allegheny 18-8		SW-262	Weldbest 308-15	Flexarc 308 L
rweld	McKay 18-8 ac-dc	No. 308	Murex Type 306	Maurath 18-8-S, ac-dc	Sureweld 308	Page-Allegheny 18-8	Racolloy 18-8	SW-362	Weldbest 308-16	Flexarc 308 TL
rweld	McKay 25-12 dc Lime		Murex 25-12	Maurath 309, ac-dc	Sureweld 309	Page-Allegheny 25-12		SW-168	Weldbest 309-15	Flexarc 309 L
rweld	McKay 25-12 ac-dc	No. 309	Murex Type 309	Maurath 309-CB	Sureweld 309	Page-Allegheny 25-12	Racolloy 25-12		Weldbest 309-16	Flexarc 309 TL
rweld	McKay 25-20 dc Lime		Murex 25-20	Maurath 310, ac-de	Sureweld 310	Page-Allegheny 25-20		SW-159	Weldbest 310-15	Flexarc 310 L
rweld	McKay 25-20 ac-dc	No. 310	Murex Type 310	Maurath 316, ac-dc	Sureweld 310	Page-Allegheny 25-20	Racolloy 25-20	SW-359	Weldbest 310-16	Flexarc 310 TL
rweld	McKay 18-8 Mo (316) dc Lime		Murex 18-8 Mo	Maurath 317	Sureweld 316	Page-Allegheny 18-8 Mo		SW-160	Weldbest 316-15	Flexarc 316 L
rweld	McKay 18-8 Mo (316) ac-dc	No. 316	Murex Type 316	Maurath 318	Sureweld 316	Page-Allegheny 18-8 Mo	Racolloy 18-12 (2-3 Mo)	SW-260	Weldbest 316-16	Flexarc 316 TL
rweld	McKay 18-8 Mo (317) dc Lime		Murex 18-8 Mo (317)	Maurath 329	Sureweld 317	Page-Allegheny 18-8 HMo		SW-161	Weldbest 317-15	Flexarc 317 L
rweld	McKay 18-8 Mo (317) ac-dc	No. 317	Murex Type 317	Maurath 330	Sureweld 317	Page-Allegheny 18-8 HMo	Racolloy 18-12 (3-4 Mo)		Weldbest 317-16	Flexarc 317 TL
rweld	McKay 15-35 dc Lime		Murex 15-35	Maurath 347	Sureweld 330	Page-Allegheny 15-35			Weldbest 330-15	Flexarc 330 L
rweld	McKay 15-35 ac-dc	No. 330	Murex Type 330	Maurath 410	Sureweld 330	Page-Allegheny 15-35	Racolloy 330		Weldbest 330-16	
rweld	McKay 18-8 Cb Lime		Murex 19-9 Cb	Maurath 442	Sureweld 347	Page-Allegheny 18-8 Cb		SW-157	Weldbest 347-15	Flexarc 347 L
rweld	McKay 18-8 Cb ac-dc	No. 347	Murex Type 347	Maurath 443	Sureweld 347	Page-Allegheny 18-8 Cb	Racolloy 18-8 Cb	SW-357	Weldbest 347-16	Flexarc 347 TL
rweld	McKay 12 Cr dc Lime		Murex 12 Cr	Maurath 446	Sureweld 410	Page-Allegheny 12 Pct Cr		SW-153	Weldbest 410-15	Flexarc 410 L
rweld	McKay 12 Cr ac-dc	No. 410	Murex Type 410	Maurath 502	Sureweld 410	Page-Allegheny 12 Pct Cr	Racolloy 410			
rweld	McKay 16 Cr dc Lime		Murex 16 Cr	Maurath 430	Sureweld 430	Page-Allegheny 16 Pct Cr		SW-154	Weldbest 430-15	Flexarc 430 L
rweld	McKay 16 Cr ac-dc	No. 430	Murex Type 430	Maurath 16-25-6	Sureweld 430	Page-Allegheny 16 Pct Cr	Racolloy 430			
rweld	McKay 5 Cr Mo dc Lime		Murex 4-6 Chrome		Sureweld 502	Page-Allegheny 4-6 Cr Mo			Weldbest 502-15	Flexarc 502 L
rweld	McKay 5 Cr Mo ac-dc	No. 502	Murex Type 502		Sureweld 502	Page-Allegheny 4-6 Cr Mo	Racolloy 502	SW-151		

rcwelding Electrodes

hfege r.p.	Hobart Bros. Co.	Lincoln Electric Co.	McKay Co.	Marquette Mfg. Co.	Metal & Thermit Corp.	National Cylinder Gas Co.	Reid-Avery Co.	A. O. Smith Corp.	Steel Co. of Canada	Weldwire Co., Inc.	Westinghouse Electric Corp.
-1	No. 385	Shield Arc 85	McKay 715		Murex Molex	Sureweld MLY-50	Raco 74	SW-75, SW-80	Stelco Electrode No. 710		Flexarc AP-MO
2			McKay 711		Murex Type MA	Sureweld MLY-C	Raco 7011				Flexarc ACP-MO
2	16 or 716	Shield Arc LH-70	Pluralloy 70	No. 7016	HTS-100	Sureweld 7016	Raco 180-15	SW-84			Flexarc LOH-2
-2	No. 111-HT	Fleetweld 11-HT	AC Pluralloy 70		Murex Type DM	Sureweld MLY-A	Raco 180-16	SW-78, SW-78	Stelco Electrode No. 720		Flexarc DH-MO
	816		AC Pluralloy 100		Murex Type 8016-Q	Sureweld 8016	Raco 1/2 Cr-1/2 Mo	SW-81			
40-C, -B -7	916	Planeweld 1	Pluralloy 100		Murex Type 2116	Sureweld 9016	Raco 13/4 Cr-1 Mo	SW-89, SW-90			Weldbest 9015
			Pluralloy 120				Raco 10013	SW-88, SW-82			Weldbest 9016
2, -12 17 21			AC Pluralloy 120		Murex, Type AWL. 4216		Raco 230-15				Weldbest 10015
			Pluralloy 120				Raco 260-15	SW-100			Weldbest 10016
							Raco 260-15	SW-120			Weldbest 260-15

Nickel-rich layer does it—

New Alloys Stop Corrosion in SILVER-BRAZED Type 430 Joints



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- ♦ Most silver-brazed joints in Type 430 and other chrome-grade stainless steels are susceptible to separation under mildly corrosive conditions . . . Prevention depends on a nickel-rich layer over the area covered by the brazing alloy.
- ♦ Two new silver-brazing alloys make joints in Type 430 stainless completely resistant to tap-water corrosion . . . Joints made with three standard alloys will corrode some, but depth of penetration can be decreased . . . Nickel plating the stainless steel before brazing may prevent this form of corrosion . . . Soft-solder flushing does prevent it.

♦ TYPE 430 STAINLESS STEEL shows excellent resistance to corrosion in many environments. It is easily fabricated, welded and soldered. But, when it is joined by some silver-brazing alloys and exposed even to mild tap water or a humid atmosphere, a small line of red rust forms at the edge of the brazing alloy. In a short time, the joint may lose strength and fall apart. This condition, reported in service, led to a study of the cause and a cure.

Tests were conducted with many regular and experimental silver-brazing alloys. Analyses, flow points and fluidity of the most representa-

tive are given in Table I. Also listed is the corrosion resistance of joints on Type 430 stainless steel. Brazing alloys are identified by numbers and letters corresponding to various alloy types investigated.

Initial laboratory corrosion tests revealed that failures could occur in flowing tap water with such brazing alloys as 250b and 250c in as short a time as 2 days. This led to a study of a preparation of the stainless steel before brazing, loss of strength on exposure, fluxes, brazing techniques, treatment after brazing, and brazing alloy composition.

Most laboratory corrosion tests were con-

"Joints made with nickel-bearing alloy performed very well but those made with nickel-free alloy weakened after 10 days in tap water . . ."

ducted in tap water, but a 5-pct salt spray, a humid atmosphere, and a 4-pct sodium-chloride solution were also used. Specimens were of the types shown in Fig. 1. Some flanged pieces were exposed as shown; others were mounted in wood jigs so that they were stressed. Application of stress was not necessary to produce failure.

Where complete failure occurred, it was generally manifested as a relatively clean separation of the silver-brazing alloy from the stainless steel. In tap water and a humid atmosphere, there was no appreciable corrosion. Joints fell apart, or the pad-type deposits separated, with only a small line of red rust present at the edge of the brazing alloy. In the 4-pct sodium-chloride solution and the salt spray, severe corrosion of the Type 430 stainless steel occurred.

Two aspects were considered—the nature of the surface of the stainless steel and the effect of electroplating members of Type 430-to-copper assemblies. The nature of the surface of the Type 430 appeared to have no effect on the results because rolled, ground and pickled surfaces behaved in the same manner.

Nickel on 430 Effective

Copper plating the stainless part of a Type 430-copper assembly was not effective. When both parts of an assembly were nickel plated, and when the copper part alone was nickel plated, failure occurred. Yet, in two cases where only the stainless was nickel plated before brazing, no failures were observed in more than a year. It would seem likely that an adherent heavy nickel plate on Type 430 might be effective in preventing failure.

Tests were made to observe the strength of silver-brazed joints before and after exposure to tap water. Type 430 was brazed to Type 301 stainless with alloys 250b and 253a. On pulling in tension before immersion, fracture occurred in the Type 430 well away from the joint at a 2600-lb load, indicating a strong joint. After immersion for 10 days, specimens brazed with alloy 250b broke apart along the Type 430 interface at loads of 300 lb and less. Those made with alloy 253a, which contains 3 pct nickel,

ACKNOWLEDGMENTS

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again broke in the Type 430 well away from the interface.

Similar exposures were made in a 4 pct sodium-chloride solution. When pulled after 10 days in test, a specimen made with alloy 250b broke in the Type 430 along the interface where severe corrosion had occurred. The joint itself did not pull apart completely. The specimen made with alloy 253a broke in the Type 430 well away from the joint.

Joints made with nickel-bearing alloy 253a performed exceedingly well. Those made with the nickel-free alloy 250b were greatly weakened after 10 days in tap water. In the salt solution, a deep crevice developed between nickel-free alloy 250b and Type 430 at the interface. Type 430 corroded severely within the crevice and fractured when tension was applied.

Tests Unaffected by Flux

A number of commercial fluxes were used with experimental variations. None had any effect upon the results, except those to which nickel powder and nickel fluoride were added in an attempt to deposit nickel during the brazing operation. Even the nickel-bearing fluxes were of little benefit and were soon abandoned.

Most specimens were torch-brazed, although some were furnace-brazed in air and in hydrogen. The brazing alloys were first applied in the usual manner at temperatures 25 to 50°F above their flow points. Then the rate of heating was varied to exaggerate liquation (slow heating) or to minimize it (fast heating).

Extended brazing periods and higher brazing temperatures were finally tried in an attempt to improve the alloying characteristics of the brazing alloys that did not deposit a nickel-rich interface. No marked effects were observed other than with certain nickel-bearing brazing alloys. With the latter, the brazing technique can be important.

Stress relieving, grinding, sandblasting, electropolishing, electroplating, and soft solder flushing (95 pct tin-5 pct antimony) were tried after brazing. Of these, only the last, the soft solder coating was effective.

A large number of specimens was prepared and tested to determine the effect of alloy composition. All the silver-brazing alloys used are listed in the table. Failures occurred with all the nickel-free alloys and most of the experimental nickel-containing alloys. Nickel-containing alloys 223c, 233b, 233g, and 263a performed in an excellent manner. Alloys 223a, 243a, 243b, and 253a were partly effective.

Specimens were prepared using several other chromium stainless grades. Types 403, 410,

430 Ti and 446 were susceptible to failure of the kind that occurred at Type 430 joints. Carbon steel specimens, however, showed no tendency toward failure. The steel itself rusted but the joints remained sound.

At least three reasons have been advanced to explain the failure of silver-brazed joints in ferritic stainless steel: (1) poor joints, (2) galvanic corrosion, and (3) crevice corrosion. It is believed that the failures can be accounted for by a crevice corrosion mechanism.

The strength test data are an excellent indication that initially the joints are good and sound. When exposed for 10 days in tap water, the pieces suffered a marked loss in strength, accompanied by a line of rust at the brazing-alloy interface. After 10 days in salt water, corrosion was extensive on a similar specimen at the Type 430 interface, resulting in fracture when tension was applied. Obviously, corrosion is a factor.

If galvanic corrosion were the cause, visible etching or pitting should occur on the surface of one of the dissimilar metals in the immediate vicinity of the interface. This does not take place. Instead, the joint separates due to action within the interface. Moreover, if galvanic corrosion were responsible, it would be reasonable to assume that joints made on steel specimens would certainly be affected. Steel joints were sound after exposure to flowing tap water for more than a year.

The manner in which the joints corrode points to the phenomenon of crevice corrosion of the oxygen concentration cell type. Initially, the only existing crevices are minute imperfections at or near the outer edge of the brazing alloy. These are bound to be present in all fillet

edges, including edges that do not corrode as well as those that do.

The mechanism of crevice corrosion by oxygen concentration cell action is well known, and the mechanism in the present case may be described in this manner. The area under an imperfection is depleted of oxygen and becomes anodic. The infinitely greater area outside is relatively oxygen-rich and cathodic. This produces an oxygen concentration cell.

Once the cell has begun to function, the stainless steel on the inside would be in an active condition and that on the outside passive. Then the oxygen concentration differential and the potential between the active and passive stainless steel might provide the energy needed for growth of a large crevice from an imperfection. A number of such crevices link together as the action proceeds, and separation eventually occurs.

Phenomena Described

Under these conditions, any iron going into solution within the crevice would be in the form of ferrous ions, which are soluble. As these ions migrate to the mouth of the crevice, ferric hydroxide would be formed, which would then precipitate as red rust.

This hypothesis as applied to silver-brazed joints may have its weaknesses, but it describes the phenomena accompanying the separation quite aptly. The first evidence of corrosion is usually the appearance of one or more rust spots around the periphery of a fillet. These develop into rust segments that may join up with other segments or may develop independently.

A crevice may develop rapidly at the thin edges of a silver-brazing alloy fillet that is sus-



FIG. 1—Bead of alloy 253a was easily removed from flanged specimen after 29-day exposure to

flowing tap water. Pad of alloy 320b (below) came off specimen after 90 days.

"It is a layer of nickel-rich constituent over the whole area which prevents separation . . ."

ceptible to this sort of attack. Fig. 2 shows the edge of a deposit of alloy 250b on Type 430. This specimen had merely been rinsed with tap water after brazing to remove the flux and then copper plated to prevent rounding of the surface during micropolishing.

Presence of a nickel-rich interface seems to inhibit progress of an expanding crevice. Joints made with silver-brazing alloys providing a nickel-rich interface over most of the area covered have withstood running tap water for more than a year. This appears to be so despite the fact that a rusted crevice developed at the edges within a few days.

If a silver-brazing alloy can deposit a fairly uniform layer of a nickel-rich constituent over the entire area of the Type 430 that it covers, separation does not occur. Figs. 3 and 4 show the nickel-rich layer typical of alloys 233g and 233b, at the center and edge, respectively.

A silver-brazing alloy such as 253a, however, can deposit a nickel-rich constituent over only

part of the covering area. Fig. 5 reveals the nickel-rich layer at the center of a 253a deposit, while Fig. 6 shows no nickel-rich coating at the edge of a fillet. Under these circumstances a crevice will develop at the edges and penetrate to the area covered by the nickel-rich material. Then, apparently, it stops.

When a silver-brazing alloy deposits no nickel-rich constituent over any part of the covering area, the crevice that develops will eventually destroy the joint. A deposit of this nature is shown in Fig. 2.

The many unsatisfactory nickel-containing alloys listed in the table attest that it takes a particular type of alloy to deposit nickel in the manner required. This derives from the complex nature of the deposition process. For example, during the brazing cycle, nickel must migrate to the stainless steel, deposit upon it, and alloy with it. In practice, the nickel-containing brazing alloy must be capable of delivering nickel-rich particles at the interface. In this sense, dilute nickel particles are entirely ineffective.

Even if a nickel-containing alloy produces a nickel-rich deposit over the body of the joint, it may not carry enough nickel to the fillet edge to produce a satisfactory deposit at the edge.

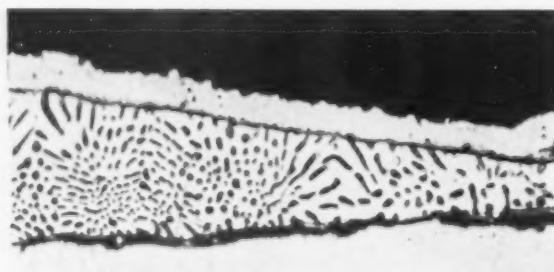


FIG. 2—Edge of alloy 250b at 1000X after washing in tap water and copper plating to aid micro preparation, separates from base metal.

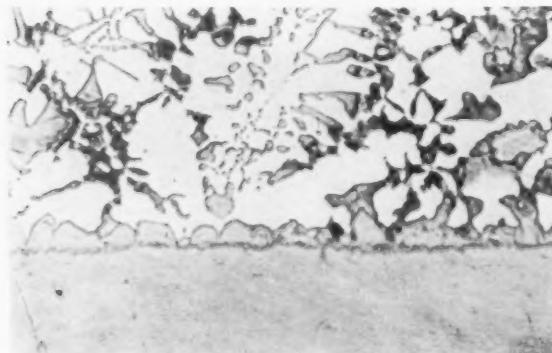


FIG. 3—Cross-section toward center of alloy 233g deposit on Type 430 shows presence of a nickel-rich constituent at interface.

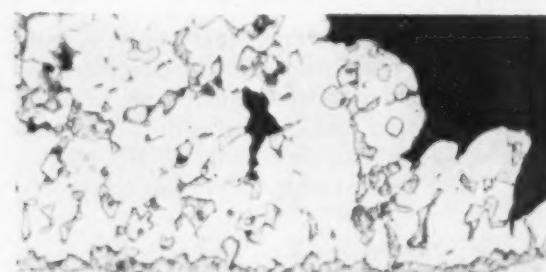


FIG. 4—Deposit of silver-brazing alloy 233b on Type 430 stainless steel reveals presence of nickel-rich constituent along edge.

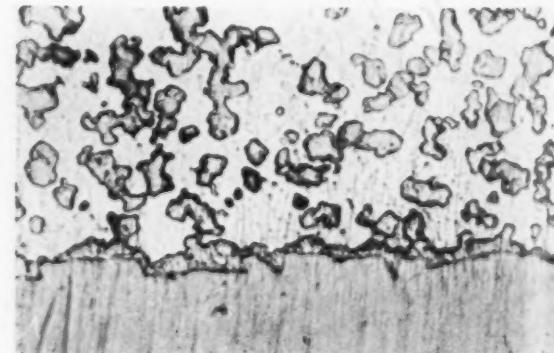


FIG. 5—Center of deposit of alloy 253a on Type 430 stainless has nickel-rich constituent at interface similar to that of 233g deposit.

At its simplest, it is the amount of nickel-rich constituent present in the small volume of molten metal found at the thin edges of a very fluid or liquating brazing alloy.

Almost all brazing alloys having the right kind of nickel-rich constituent liquefy during brazing. Thus, the alloy that runs out to the edges is deficient in this respect because it has run away from the nickel components. This is the reason why relatively free-flowing alloys such as 243a and 243b corrode at the edges and sluggish alloys such as 233b and 233g do not.

Migration Takes Time

Migration of the nickel-rich particles might be expected to involve a time element, which it apparently does. Thus an extremely short brazing cycle (induction brazing for example) may produce a poor joint, where a long brazing cycle (furnace brazing) would be more desirable.

Superheat of 100 to 200° F with respect to the flow point is slightly beneficial in some cases. The improvement is probably related to a longer time interval above the flow point or an increase in the mobility of the nickel particles at high temperatures, or both.

Silver-brazing alloys 233b and 233g were developed as a result of this study. These are relatively high-temperature alloys and are much less fluid than standard silver-brazing alloys. Still, joints can be made with them and alloy 233b is made in strip or wire form while alloy 233g is available in powder form.

Joints made with three standard alloys, 243a, 243b and 253a, will corrode to some degree, but depth of corrosion penetration may be decreased by avoiding (1) liquation, (2) extremely short brazing periods, and (3) underheating. Moreover, 243b joints will corrode less than 253a joints, and 253a joints less than 243a joints.

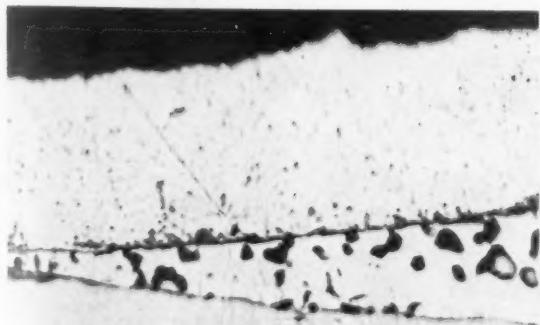


FIG. 6—Edge of deposit of alloy 253a, after washing in tap water and copper plating to aid micro preparation, has no nickel-rich constituent.

CORROSION RESISTANCE OF JOINTS

No.	Composition, pct						Flow Point, °F	Fluidity on Type 430	Corro- sion Resis- tance on Type 430
	Ag	Cu	Cd	Mn	Sn	Zn			
Alpha, and/or, Alpha-Beta Type Copper Base Alloys									
110c		60				40	11	1655 (1700)	Good Good
113a		47				42			OK OK
120a	9	53				38		1565	Good
c	30	38				32		1410	Good
123a	40	26				32	2	1350	Good
Eutecticiferous Type, Copper-Silver Base Alloys									
210a	72	28						1435	Very Poor Poor*
213a	70.6	27.4					2	(1480)	NG NG
220a	61	34		5				1410 (1370)	Good Good
c	46	39		15			2	(1445)	Good Fair*
223a	65	28		5			8	(1600)	OK (?) OK
c	50	36		6					
230a	60	30			10		2.5	1325 (1475)	Poor Poor Poor
233b	63	28.5			8		2	(1400)	NG OK OK
g	60	28			10				
240a	25	52.5				22.5		1575	Good*
c	45	30				25		1370	Good*
d	60	25				15		1325	Good
243a	40	30				28	2	1435	Good*
b	40	30				25	5	1560	Fair
c	65.1	27.9				5	2	1420	Poor
g	61.6	26.4				10	2	1375	Fair
h	60	16				22	2	1250	Good
250a	35	26	18			21		1295	Good*
b	50	18.5	18			16.5		1175	Good
c	45	15	24			16		1145	Good
253a	50	15.5	16			15.5	3	1270	Good*
b	50	13	13			21	3	1205	Good
260a	57.3	32.7		3	7		2	1345 (1475)	Good Good
263a	43	37		15	3				NG OK
270a	54	18		5		23		1285 (1350)	Good Excellent
273a	52.5	17.5		5		23	2		NG NG
280a	56	22			5	17	2	1205	Good
283a	62.5	27.5			2.7	5.3	2	(1325)	Poor
b	57	23			3	15	2		Good

Alpha, and/or, Alpha-Beta Type Silver Base Alloys

320a	85			15				1760	Good	OK (?)
330b	75					25		1345	Good	NG
333c	74					25	1	(1355)	Good	NG
d	73					25	2	(1375)	Good	NG
e	70					25	5	(1425)	Fair*	(?)
353b	75				3	20	2	(1400)	Good	(?)

ABOUT THE TABLE

*Denotes a strong tendency toward liquation.

Flow point figures within parentheses indicate approximate values.

In classifying corrosion resistance of joints, spreading test bonds were considered NG if: (a) bond failed in 5 to 10 days in flowing tap water; (b) 5- to 10-day crevice was of the type that would fail on longer exposures; (c) Extreme measures as prolonged heating during brazing were not distinctly beneficial and did not, in the case of the nickel-containing alloys, result in a suitable nickel-rich deposit.

Similar joints classified as (?) were ordinarily NG, but were susceptible to improvement by prolonged heating at elevated temperatures.

Bonds marked OK (?) underwent partial corrosion, but did not fail, when brazed in a conventional manner.

OK signifies that no corrosion took place except for very limited peripheral attack following very quick brazing at very low temperatures.



By J. Wischhusen

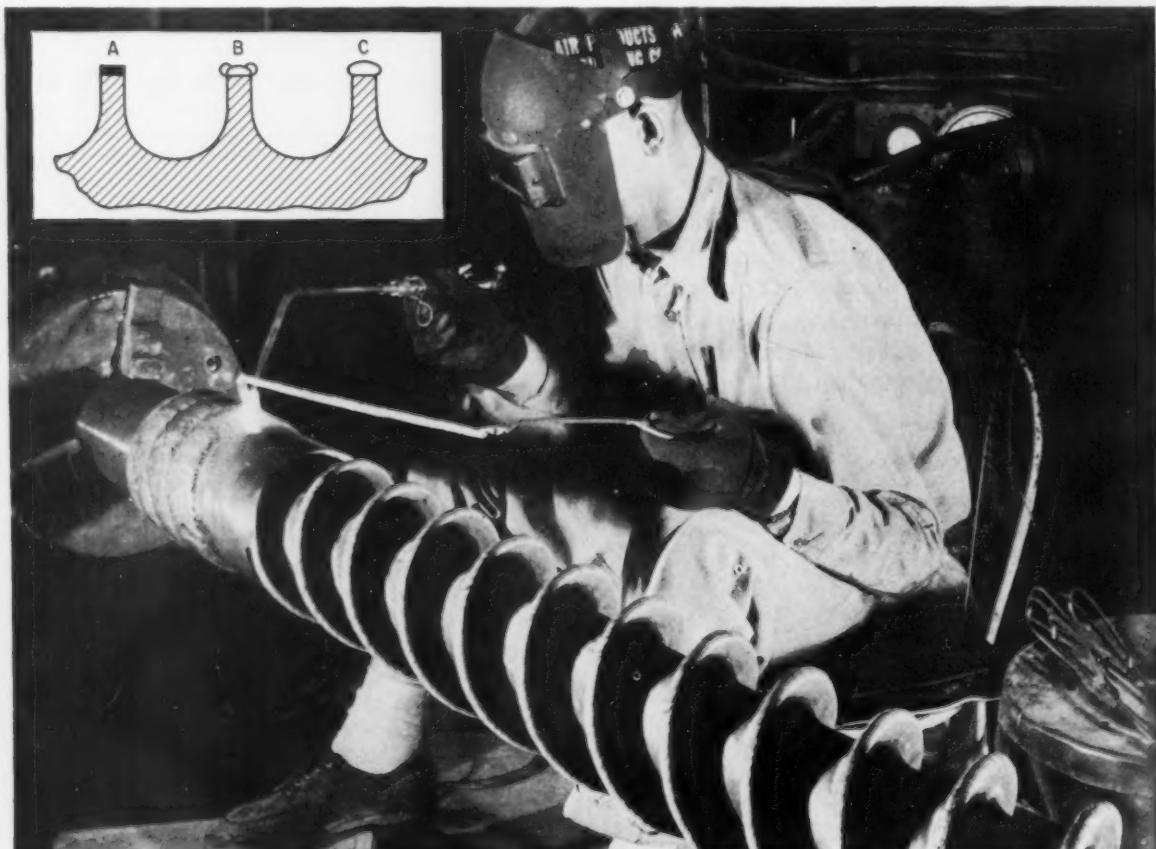
Vice President, Engineering
Cleveland Hard Facing, Inc.
Cleveland

◆ REBUILDING WORN AREAS on equipment has been an essential part of welding since the acceptance of welding as an art. By using welding rods of superior physical properties over the base material, the life of the part was prolonged beyond that of its original usefulness.

Intricate Procedures Solve

This became known as hard surfacing or hard facing, and was accomplished mostly by arc-welding with iron-base alloys.

About 20 years ago, some new aspects of hard facing came into being. In addition to good wearing qualities, high temperature and corrosion properties were also needed, and precision finished surfaces were often demanded. These combined requirements were met by the development of high cobalt-chrome-tungsten type alloys commonly known as Stellites, and others whose alloy content usually totaled 100 pct and excluded iron as a prime constituent.



EXTRUSION SCREW of Type 304 stainless requires a flawless deposit of hard-facing material along the flight edges. Because these edges must

be machined square (A), deposited alloy must overlap leading and trailing edges. Deposition can be done either in three passes (B) or one (C).

♦ Hard facing is an art within the welding art . . . Higher efficiency of today's equipment calls for combinations of surfacing properties—long life, good service at high temperatures, corrosion resistance . . . Solutions to many problems also require combinations—of knowledge, experience, skill and ingenuity.

♦ One job required buildup along flight edge of extrusion screw—without flaws, with overhangs on leading and trailing edges, and low residual stresses . . . It was done by two different methods . . . Another job involved hard facing a cage wall in a steam valve . . . A semiautomatic setup using an oscillating, multiple-rod, gravity-fed welding head solved it.

Tough HARD-FACING Problems

Application of these materials has been mainly by the oxyacetylene method. It requires skillful technique inasmuch as minimum interalloying with the base material is essential. The tendency toward shrinkage, cavitation, and thermal cracking adds to the importance of careful torch handling.

All types of equipment, including internal combustion engines, heavy-duty pumps, high-pressure steam regulators, corrosion-resistant valves, intensive mixers, and extruders are being built for higher efficiency. Their various precision components, which are subject to severe

erosion and wear, require a composite structure consisting of a Co-Cr-W type overlay. Without hard facing, many parts would last only a few hours in service.

In hard facing an extrusion screw of Type 304 stainless, careful application of the alloy is extremely important. A flawless surface, after finish machining and grinding, is an absolute requisite. The finished buildup on the edges of the threads must be about 1/16 to 3/32 in. and have square corners. If enough hard-facing material is to be applied, three weld beads are necessary if the flight edge is wide—a major



HARD-FACED PARTS form a wide and varied assortment which exemplifies some of the requirements to be met. These as-welded parts have been hard faced with cobalt-chrome-tungsten type alloys.

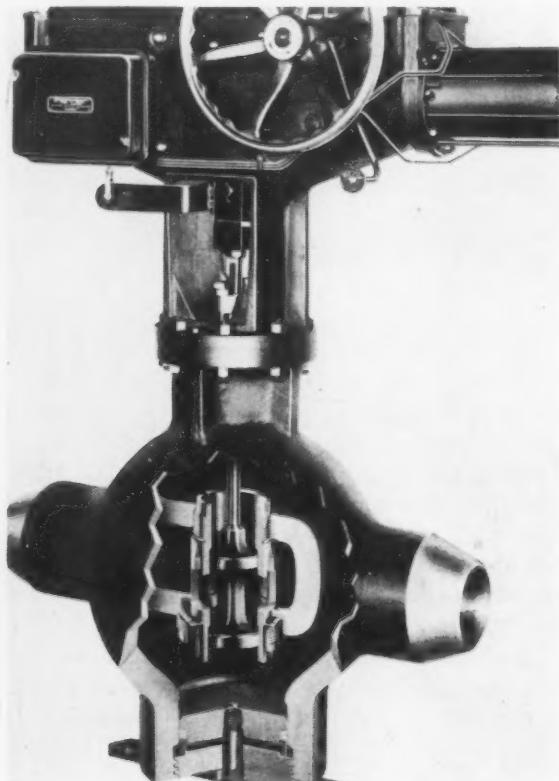
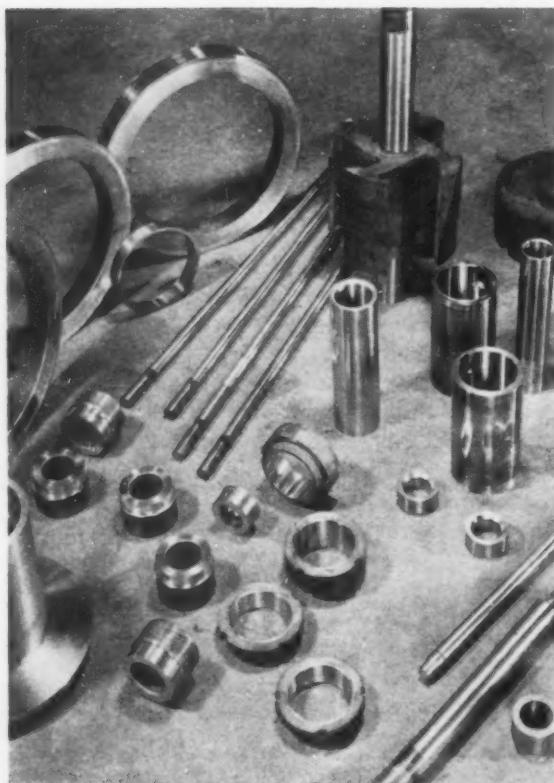


Photo courtesy Bailey Meter Co.

DUMBBELL STYLE DISK and cage of steam valve (in cutaway portion) requires skillful application of hard-facing material. Heavy overlay and uniform heat removal help to overcome size problems.

"Machining is a fast method of removing surplus material from hard-facing deposits. It allows inspection for porosity and cracking, and readily reveals low spots due to insufficient buildup"



HARD-FACED PARTS such as these must be machined to close tolerances by grinding. This job is made difficult by the nature of the deposit.

bead in the center and smaller beads on the leading and trailing edges.

Smaller flight widths need only a single bead with leading and trailing edges overhanging to allow for finishing the edges square. The flight must also be made in a continuous deposit so that high residual stresses are minimized. This avoids cracks which would propagate into the flight proper causing premature mechanical failure.

Another difficult problem is that of hard facing the cage wall in a steam valve assembly, also made of Type 304 stainless. The area overlaid is in effect an internal diameter and requires as much as 10 lb of welding rod to complete each end portion in which a dumb-bell-style disk glides open and shut.

During hard facing, the cage tends to draw in and lose its size on the internal diameter. When this occurs, subsequent machining to size removes all the overlay. The wall thickness must

therefore be of sufficient thickness to overcome most of the collapsing. But, this in turn creates high residual tensile stresses if the alloy is not applied properly and if heat is not removed uniformly. If the base material requires heat treatment, it should be done immediately after hard facing.

Alloying ingredients in certain base materials sometimes trouble the welder. Sulfur, phosphorus or selenium in Type 303 stainless affect its weldability, as does the aluminum content in the hardenable nickel-copper alloys.

Weldability a Problem

High hardenability in certain martensitic alloys, such as Type 410 stainless and 14-4-1 die steels, is still another source of difficulty. Annealing or drawing immediately after hard facing modifies the hardness pickup and prevents cracking.

Weldability of the hard-facing rod can be a problem in itself. When melting some hard-facing materials, a tenacious oxide scale forms unless the rod is adequately protected from atmospheric oxygen. Inert gas-shielded arc-welding, by excluding atmospheric oxygen and providing high localized heat, overcomes this poor welding characteristic. This welding method also works well in hard facing certain nonferrous materials such as copper.

After hard facing a part, it is customary to rough machine the overlay to a size which leaves enough stock for finish grinding. Machining is a fast means of removing surplus material. It also allows for inspection of the work for porosity and cracking. Low spots due to insufficient buildup are revealed readily, making it possible to reweld such areas before proceeding with the finish grinding operation.

Medium Grit Best for Grinding

A heavy machining cut prevents a burnishing action by the cutting tool. Also, by taking a large cut, chatter is minimized since the intermittency that might be created by high spots on the as-welded surface is avoided. Use of coolants are recommended only on a production machining setup where high cutting speeds and form tools are employed.

Most hard-faced parts of the type described require a ground finish to close tolerances and highly smooth surfaces. By virtue of their wear-resistant and abrasion-resistant qualities, hard-faced surfaces are not easy to grind. They tend

to build a glazed surface on the grinding wheels, lowering their ability to cut. A wheel of medium grit and medium hardness creates a breakdown of the wheel surface and provides a self-dressing action.

In hard facing the dumb-bell-style disk for the steam valve, a single-pass overlay 4 to 5 in. wide was made at each end around the 6-in. diam. These deposits were very smooth. They are the result of an initial attempt to apply hard-facing material by semiautomatic means. The Co-Cr-W alloys are best applied by oxy-acetylene welding since the rods are furnished in a cast uncoated form.

Multiple-Rod Setup Used

Application was accomplished by using a multiple-rod, gravity-fed welding head which oscillated while turning the part on its axis. Two sources of heat were needed—one to pre-heat the work surface and the other to serve a welding and cut-off function, melting the rods as they were wetted into the surface of the base metal.

By using the proper number of welding rods along with the correct horizontal oscillation, the required overhang was obtained at the edges. It was inadvisable to use this semiautomatic method to overlay a critical diameter of the disk.

Sleeves, shafts, and wear rings are other items which can be adapted to this method if

the quantity of pieces warrants the setup. This form of automatic deposition is also used for wide and long lineal deposits on wear strips and shear blade applications. While more oxygen and acetylene are consumed by this method, the increased costs are more than offset by the speed of alloy deposition in a given time.

One of the drawbacks to semiautomatic operation is the inability to dwell the welding operation for any reason. The base material must have uniform weldability so that the progress of the overlay deposit is not interrupted.

Demands More Exacting

Mechanization can also be accomplished by rotating the parts vertically to the welding head. By this method, welding rod can be fed in two ways. One is by gravity feed and the other by puddling. The latter method amounts to dripping the melted rod onto an area desired, usually a groove.

Hard facing for high temperature, wear and corrosion-resistant service has many and varied problems from the beginning of a job to the end. Since demands for composite parts are increasing, and becoming more exacting, the hard facer must be both a welding specialist and a machinist. At the same time, the metallurgist is challenged to provide better hard-facing materials which will extend the life of machine tools and other equipment used under high-temperature conditions.



HEAVY MACHINING CUT removes surplus hard-facing material quickly and minimizes chat-

ter. Coolants are recommended only in production setups using high machining speeds.



Maintenance Welding Keeps Production Moving



By W. G. Patton
Asst. Technical Editor

- ◆ Providing maintenance welding for one of the world's largest industrial units proved surprisingly simple and effective when Ford broke the job down into small pieces . . . Maintenance welding in the River Rouge plants embraces practically every type of industrial welding operation.
- ◆ Peak production of the past few years, expansion programs, and continued rearrangements for more efficient operations have made the "maintenance team" an important factor in keeping production on the move . . . Welding, as a member of that team, has helped keep machines and production lines on the go.

◆ ADMINISTRATION of one of the world's largest maintenance welding operations was greatly simplified when Ford Motor Co. decided to decentralize its great River Rouge plant into a group of autonomous units. Ford's recent multi-million dollar expansion at the Rouge made maintenance a greater problem than ever. Now, with each major division on its own, more maintenance welding than ever is handled in smaller, more closely knit groups.

Maintenance welding at Ford embraces practically every type of industrial welding operation. Principal operating departments include: pressed metals plant, tool and die division, steelmill, assembly plant, motor parts building, motor assembly, power plants, glass plant, ore docks and railroad. Each unit is responsible for its own operations, including maintenance and mainten-

ance welding, and is staffed to operate on a self-sustaining basis.

Ford maintenance men work on 81 miles of conveyor system located in the Rouge. The company has a large boat dock and operates three large ore carriers. There are more than 110 miles of railroad in the Rouge. The Ford fully integrated steel mill includes three blast furnaces, 10 openhearts and a large sheet and bar mill. There are 22 Ford locomotives and 1276 Ford-owned freight cars at Detroit. There are 866 presses in the Rouge stamping plant and more than 13,000 machine tools within the 9,425,588 sq ft of floor space under roof.

To meet the requirements of its many operating departments, Ford has 480 general maintenance welders. These men are assigned to the several departments and may work as welders in

the welding shop maintained by each department or in the plant. Welders are often assigned to maintenance crews responsible for installing new piping, moving machines or conveyors, etc.

There are 96 welding specialists trained to repair or modify tools and dies. In addition to these specialists there is another group of 240 men trained as welding machine and welding fixture repair men who do bench work and make mechanical repairs related to the upkeep and maintenance of welding operations. Maintenance welding performed at the Rouge embraces several major classifications.

Machine repair

Modernization of the Ford-Rouge plant has been going on continuously since the end of World War II. Millions of dollars have been invested in new equipment, rearranging plant layout and providing additional conveyors. Thousands of machines and presses have to be moved each month. With the added maintenance resulting from peak automobile production during the past few years, repairs to machinery have reached a new high.

Simple repairs to cast iron parts of machines are generally made by brazing, using oxyacetylene process or by electric arc welding using a bronze rod. The welding method and the rod are selected to fit the job.

During the past few years, wide use has been made of a nickel rod and electric arc for machining repairs. During the nickel shortage, nickel content of the rod was cut to about 50 pct. Nickel content is now running at about 60 pct but is expected to increase eventually with the lifting of restrictions on nickel.

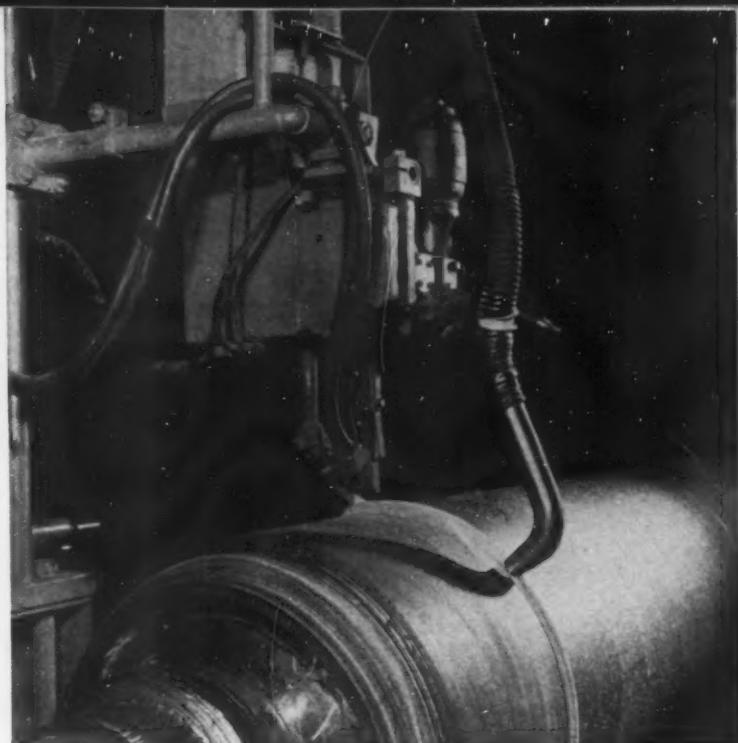
Electric welds can be made quickly with a nickel rod. Since welding can be done in place, long shutdowns are avoided. The method is often used as a stop-gap until permanent repairs can be made.

Ford welders have developed an unusual technique for inserting gear teeth in a large flywheel. Studs are inserted in the damaged area, if required. The gear tooth is rebuilt with a conventional brazing rod using an oxyacetylene torch or an electric arc with a nickel on high nickel content electrode. Final grinding is done on the machine. This has proved to be an effective way to repair machines with minimum loss of production hours.

Rebuilding shafts

Metal spraying is employed for salvaging equipment wherever it is considered to be economical. Work is often sent to outside contractors since Ford no longer maintains the facilities necessary for many of its big jobs.

A unique application of metal spraying by Ford is the use of hard surfacing on shafts of polishing and grinding equipment at the glass plant. Prior to going into service, a resurfacing material is sprayed on the shafts to increase wear and cor-



SUBMERGED ARC WELDING is used to rebuild table roll for steel mill. Initial weld is 0.65 C steel. Top layer is 420 stainless. Flux, poured on to retain heat, also provides alloy.



MANIPULATOR RACK RAM guide roller, used in steel rolling mill, before and after submerged melt processing. Roller is machined after welding.

BRONZE FILLER was used to repair these parts. Right, coke oven door extractor housing. Center, coal charging chute. Left, bearing cap.



"Crane wheels are being repaired on a lathe, using submerged arc-welding for the buildup . . ."

rosion resistance. About 1/16 in. of metal is applied. Shafts can be reground and built up again as wear occurs.

Before the method was used, shafts in the glass plant lasted, on an average, about 90 days. Metal sprayed shafts last three or more times as long before resurfacing becomes necessary. Ford also metal sprays shafts and buckets and other equipment where experience has shown this method is practical.

Special lathes have been set up at the Rouge to resurface steel mill rolls. The electrode is fed automatically as the roll is rotated. The weld is made under the protection of a granular flux which is also fed automatically. The proper electrode is selected to fit the job.

Bucket lips wear down quickly during intensive service in the Ford-Rouge foundry. After the bucket lip is worn back perhaps 1½ in., the worn surface is built up with suitable electrodes. Ad-

ditional resistance to wear is provided by depositing a layer of tungsten carbide hard surfacing material over the bucket lip to a depth of 1/8 in. The hard surfacing is deposited on both sides of the metal.

Similarly, mill guides and other parts subjected to wear are protected by hard surfacing material. The use of these materials is growing rapidly.

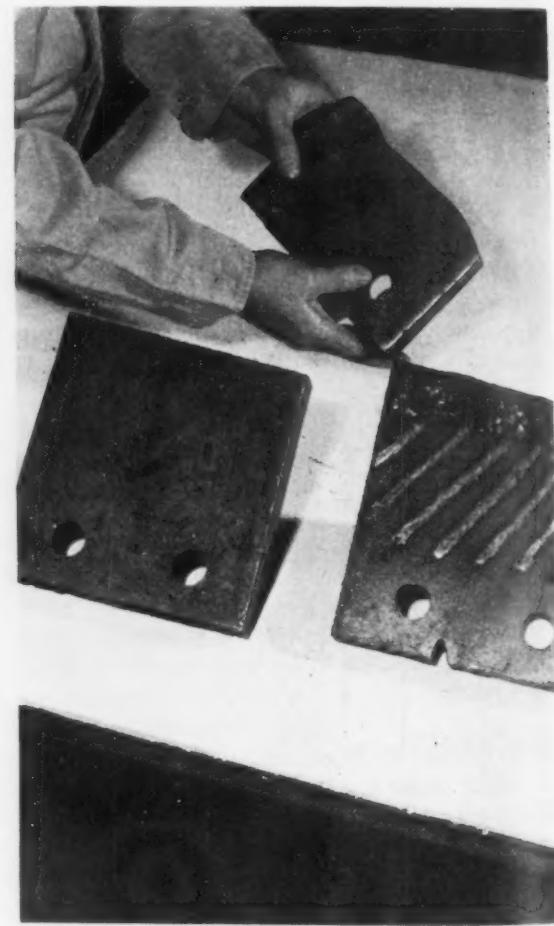
Many crane wheels are being repaired on a lathe, using a technique similar to the one for repairing rolls. Submerged arcwelding is used. Successful use of this method largely depends on ability to build up a radius that will not require too much machining. Occasionally, a stainless steel rod is used. Where wear is involved, a chrome-manganese or chrome-moly electrode is often used.

Most repairs to furnaces and ladles are made using hand welding. Recently, a semiautomatic submerged arewelding machine in which wire and flux is fed automatically has been tried. The flux hopper must be filled before each operation is started. Some experimental work with thermit welding has also been attempted.

Conventional thermit welding is used for rail



TUNGSTEN CARBIDE is successfully used in hard surfacing operations to extend life of many heavy parts subject to severe service. Here, lip of ore bucket is restored by hard surfacing.



HARD SURFACING lengthens pug mill blade life. Manganese blade, top, had 10-day service life. Blade made from hard unsurfaced boiler plate stood up for 60 days in pug mill service.



PORTABLE WELDING UNIT used for plantwide welding and emergencies generates own elec-

tricity. Unit, equipped for gas welding, cutting, operates in the 1200-acre River Rouge area.

repair work. Molds designed for the job and packaged welding materials are purchased from suppliers.

Large numbers of cast iron and steel dies are repaired at the Rouge. In the case of worn cast iron form dies, the usual practice is to preheat and apply a layer of nickel over the worn area. A rod depositing metal that resists wear is then used. Typical electrodes include work hardening austenitic types. Studding may be used if necessary.

In addition to so-called progressive dies which are generally made of steel, maintenance welding on large numbers of cold heading and hot work dies is required. With few exceptions, conventional practices are used, employing rods recommended by the various welding suppliers for that particular service.

Conveyor hooks

Making, revising and repairing conveyor hooks and fixtures is a year round activity. In addition to a steel fabricating shop, Ford maintains a large blacksmith shop. Much of the time of this group, employing about 20 workers, is taken up with making parts for the upkeep and maintenance of all types of plant equipment.

Sometimes the volume of work is large enough to warrant special tooling. A typical example is a special fixture designed by a plant foreman to hold a sand bucket in the best position for weld-

ing. Use of this fixture reduced welding time approximately 50 pct.

Wear-resistant materials are often applied at critical points on conveyor systems. Typical examples are fast-wearing rollers or heavily stressed conveyor links.

Where excessive wear may occur in service, hard surfacing is often applied prior to installation of a new gear. Some jobs which formerly ran only 2 or 3 weeks have been made to run 5 or 6 weeks or longer if this precaution is taken.

The resurfacing of piercing punches and cut-off blades is typical of applications where hard surfacing pays off for Ford. The practice is not universal but is often used.

Carbide tips for cutting tools and milling cutters are specified wherever the practice can be justified on an economic basis. Silver brazing is generally used.

A considerable amount of experimental research work is performed each year to develop improved welding practices for maintenance welding. Welding techniques in use are constantly checked against industry practice to help improve the efficiency of operations. A typical example is the current investigation of Sigma welding for maintenance. Up to the present time, the process has not been assigned to any particular job although the method shows promise, particularly where the welding of aluminum is involved.

All in the planning—

- ◆ Coordination of all key factors is the important element in producing consistently good resistance welds . . . Bulk of work is with small and moderate-sized parts where precontrol is essential . . . Resistance welding installation requires some basic thinking by management and detailed thinking by experts.
- ◆ Broadest application is spot welding of lap joints . . . Numerous factors must be considered and worked out but it takes only one miscue to halt a production line . . . Selection of equipment requires special attention . . . Other factors such as plant layout and flow of materials are essential adjuncts to the welding setup.

◆ CONSISTENTLY GOOD resistance welds require a well-planned setup which coordinates all of the important factors. The occasional difficult or big job has its interesting aspects, but it is the small or moderate-sized parts which comprise the bulk of resistance-welded assemblies. Such jobs may require little engineering time, a small shop setup or relatively simple equipment, but the most important element lies in the ability to produce satisfactory welds consistently.

In large-scale production setups, control over the essential conditions is vital since any variation results in an error multiplied many times over. Once pre-established conditions have been carefully selected and tested, rigid control over these conditions will produce quality welds.

One small fabricator learned the importance of precontrol, but it was learned the hard way. He designed a useful product, made a few samples virtually by hand, and had even made arrangements for its sale and distribution. Unfortunately, he was unable to reproduce the product consistently enough for the venture to be profitable. The spot welder, inadequate to produce good welds consistently, caused a high percentage of rejects. Moreover, the power supply was such that it would not have been suitable even if the proper welder was used.

After some study, the control was modified to overcome certain shortcomings of the machine and to resume production—but at a very slow rate. Later, adequate power facilities and a proper machine were installed. Production quickly reached the expected rate and rejects were held to a low percentage. The lesson learned was that precontrol is the essential element in a resistance

Precontrol Aids



By Myron Zucker
Consultant
Detroit

welding line. Without it, considerable additional expense can be expected.

Some basic thoughts for management in considering installation of a resistance welding line, or a new product, are:

- † An understanding of general welding requirements.
- † Product capable of being welded.
- † Machines of appropriate type, correct size, and proper controls and tooling.
- † Adequate utilities.
- † Processes for preparing parts for welding.
- † Trained manpower (for installation, setting up, operation and maintenance).
- † Quality control setup.

Other requirements such as plant layout and flow of materials, although out of the scope of the welding operation, should receive the same attention.

Each Job Differs

The broadest application of resistance welding is making lap welds in sheet steel. Other applications using spot, seam and projection welders include fastening of nuts and studs, hot-upsetting, resistance-heat brazing and seam welding of tubing. Another field of resistance welding involves the nonferrous metals and alloys such as aluminum, stainless and titanium for aircraft uses; copper, silver, brass and bimetal for electrical uses. Still another field is butt welding of sheet metal for moldings and heavy parts such as forgings.

Each particular job emphasizes a different set of requirements. It may differ in accuracy of location, finished appearance, electrical conduction

Resistance Weld Uniformity, Quality

tivity; or metallurgically as in coalescence, corrosion resistance or hardness. These are only some of the detailed problems which must be considered after the basic requirements.

The most frequent routine in resistance welding is that of making a spot weld. The sheets are overlapped and pressed together by clamps or electrodes having small contact areas. Current is passed through them until it develops sufficient heat to form a small weld puddle between the sheets. The current is then stopped, permitting the liquid metal to cool and solidify. In the process, the metal from one sheet coalesces with that of the other to form a weld nugget.

Many have seen this routine repeated numerous times, but few realize the requirements which must be met in making a so-called simple spot weld. First, sheets must be lapped a minimum distance so that the weld nugget will be in solid metal, usually $\frac{1}{2}$ to 1 in. Another requirement is application of sufficient pressure on the sheets to provide the correct mechanical and electrical conditions to create the nugget. These pressure values are measured in hundreds of pounds, sometimes in thousands, and are additional to the pressure required for bringing the surfaces together.

Timing of Current Important

Contact areas of clamps, tips or electrodes should be such as to produce a weld nugget having the full strength of the sheet. Ordinarily, the size of the clamp contact area ranges from $\frac{1}{8}$ to $\frac{3}{8}$ in. diam. Current passing through this area should be the maximum which will melt the sheet quickly, but not explosively. Current is measured in thousands and even tens of thousands of amperes, the value depending on many factors.

Timing of current flow is essential since the current should be stopped when the weld nugget reaches optimum size. This may require from $1/100$ to $1/2$ sec. Most power supplies furnish alternating current which reverses itself 60 times per second. The best point to stop alternating current is at the end of a cycle. For this reason, welding-current time is frequently expressed in cycles.

Heat produced by electrical resistance must be of the right amount and applied in the proper

place. Sometimes this is no problem, but other times electrodes must be specially designed, electrode materials carefully selected, or unusual clamping arrangements devised. Frequently, better results can be obtained by changing from spot to projection or seam welding.

In projection welding, small embossments or projections are made on one sheet to contact the other sheet. Thus, there is no need for electrodes to localize pressure and current as in spot welding. This has certain advantages when welding heavier-gage sheet, two different gages, coated materials or other conditions which would cause excessive electrode wear. In other cases, projection welding replaces spot welding because proper dressing of electrodes becomes impractical, weld spacing is too close, or where appearance is important.

Ingenuity Increases Output

Many projection welds can be made simultaneously with the proper machine and tooling. This insures regular weld patterns and speeds production. The advantage of obtaining consistently good welds without the need of continually dressing the electrode faces, as in spot welding, appeals to many shops. It appears that operators generally have a better understanding of die-punch care than of electrode care.

Seam welding is similar to spot welding except that the electrodes are wheels between which the sheets are welded while in motion. By passing current through the sheets, either continuously or in short, fast bursts, welds are made to form a continuous joint. Hence, seam welds are used where pressure-tight joints or good appearance is desired. The most refined weld of this type is called "mash-seam" because the edge of at least one sheet is mashed into the metal of the other. It is relatively new and requires good tooling and careful handling at every stage.

Many ingenious devices and combinations are used to produce spot, projection and seam welds since it is important not only to make good welds, but to do so rapidly and at minimum investment consistent with high quality and low operating cost.

Some machines have many "guns" with each carrying an electrode so that many spots can be made with a single handling of the workpiece.

Essential for economical welding is a ram with fast followup to offset loss of pressure when metal softens under welding heat.

Others are attached to long cables for mobility around large assemblies. Still others are post-type presses or C-frame machines. Combinations of circuits, so that one transformer can supply current to numerous welds in parallel or series, are used to cut costs.

It is not the fabricator's job to pick apart a design created by someone else which he is to assemble. At the same time, he cannot expect uniformly good production if the parts present any of numerous poor aspects in design. These may include such factors as inaccessible places to weld, insufficient clearance around the spot to maneuver electrodes within the area, welds so close to flanges that the welder cannot contact these parts during welding, and the inability to clamp both sheets at both sides with sufficient strength, rigidity and current-carrying ability.

Processing Needs Watching

Some sheets will not lay flat against each other in the welder unless impractical tolerances are specified for the stampings. Processing must be watched as carefully as the design. For example, when curved sheets are tacked, arches may form which will prevent the sheets from coming together at points where the welds are to be made.

Unreasonable calls for "invisible" spot welds is another problem. Metallic paths that shunt some current away from the spot being welded is still another difficulty.

Special attention must be paid to equipment, process or timing if the job calls for spot welding sheets of radically different thicknesses, different materials, or certain materials such as unpickled hot-rolled steel, sulfur-bearing or silicon steel, hardenable steels and nonferrous alloys. The same applies to making welds near edges and where bent electrodes must be used.

Machine Designs Vary Widely

Large assemblies usually require some welds near the edges and others near the middle. Unless automatic controls are adopted for such jobs, the change in welding current may be so great that setting the machine to produce satisfactory welds at all places is virtually impossible.

Machines for resistance welding vary widely in their uses and limitations. Among the mechanical types are the rocker-arm welders generally used only for spot welding. An experienced operator can do a wide range of work with certain of the foot-operated machines. However, results are not consistent and the maximum weldable thickness is restricted by the limited pressure.

Motor-operated rocker-arm welders have a faster and more consistent rate of production than the foot-operated type. It is difficult to ad-

just them for the variety of work done in shops using such machines. Another drawback is that maintenance is high.

An air-operated type is flexible, reliable and consistent, and is used for many high production jobs involving sheets of moderate gages. On certain types of jobs, these machines can be rigged for welding several spots simultaneously. They usually use a 1000 to 2000-lb tip force and 30 to 75-kva transformers.

Fast Followup Essential

Another mechanical machine is the standard direct-acting or ram type which may be used for spot or projection welding. It can be set up and adjusted easily. It is also adaptable, flexible and reliable, and produces consistently good work. Electrode force on these machines ranges from 1000 to 50,000 lb and transformer sizes from 30 to 1000 kva.

One of the essentials for economical welding, according to some users of resistance welding equipment, is a ram with fast followup to compensate for loss of pressure which occurs when the workpiece softens under the welding heat. Many manufacturers have supplemented or replaced V-groove slides with low-friction designs, while others have incorporated low-inertia features.

The semistandard direct-acting or ram-type machine will give somewhat higher production. It is used where several parts can be loaded in one operation, or where several welds can be made in one machine. It saves space and man-hours and may produce a better weld pattern.

Seam Welders Make Roll Spots

Movable portable-gun type machines are used where the work is so large that it is easier to move the machine than the work. It is generally agreed that the work they do is not of optimum quality.

Special multiple-gun machines are single-purpose machines for high production. Maintenance costs are relatively high because of the accuracy required at all points if production is to be continuous. These machines can accommodate models of essentially the same product by a change in tooling. They take different forms such as post-type presses, table-tops, or C-frames.

Seam welders, although intended primarily for seam welds, are sometimes used for roll-spot welding of relatively long, straight lap joints. The increased speed of roll-spot welding with the work fed automatically can mean appreciable savings over spot-welding methods.

Seam welders may be classified according to their wheel arrangement. Some are designed to weld lengthwise on a cylinder, others around the

cylinders, or both. They may also be classified according to the drive on the wheels. A knurl drive is best if it can be used since it makes the upper and lower wheels travel at the same circumferential speed. Wheels are sometimes driven through their shafts by gears, and other times they serve as idlers.

Spot and projection welding are among the safer industrial processes. The principal safety concern is protection of the operators' fingers in hand-fed operations. Palm buttons are customary for initiating such machines. Recently, this electrical protection has been backed up by mechanical latches that prevent rams from dropping even in the event of electrical failure.

The health hazard from fumes can be obviated by proper welding techniques. For example,

cadmium-plated electrical contacts can be welded so rapidly that only minute quantities of cadmium are released.

Similarly, there should be no danger of sparks from the work since sparks should be eliminated by proper machine settings, by special controls if a variety of thicknesses must be welded, and by use of clean stock. However, there are exceptions where parts cannot be made to fit, or where special surface conditions like galvanizing must be overcome. In these cases, guards must be used.

Serious consideration should be given to selection of a machine of proper size. There are times when someone will select a welder with a nameplate rating of 20 kva because another shop is doing similar work on a machine with the same rating. First, a machine should not be

SPOT AND PROJECTION WELDERS CLASSIFIED BY FUNCTIONS

	Main Features	Type of Shop	Material Usually Welded	Operator Skill Required	Principal Maintenance Items	Greatest Power Problem	Adaptability to Different Jobs Within Its Capacity	Production Limitations
SPOT WELDERS ROCKER ARM	Can be toolled to reach into small openings Inexpensive	Very small, producing small, light parts	Steel	Yes	Tips Contactor (mechanical)	No	Great	(All rocker-arms) (1) Tips too easily misaligned, spoiling welds and increasing maintenance, (2) Slipping of tips may spoil welds, (3) Limited capacity. Small capacity
Foot-Operated . . .								
Motor-Driven . . .	Fast	Continuous runs	Steel	Some	Tips Motor Contactor	Seldom	Reasonable	Inconvenient to adjust timing accurately. Control over weld time only.
Air-Operated . . .	Fast, easily set up	Job-shop operations	Steel, aluminum	Some	Tips Controls	Seldom	Good	
DIRECT AIR CYLINDER Roll-Spot or Seam	Between Rocker and Ram Wheel electrodes	Job-shop production	Steel, aluminum	Some	Tips Controls	Seldom	Good	
	High production	High production specialties	Steel, coated steel	Little	Wheels, bearings Controls	Usually	Specialized	Designed for relatively long lap joints (roll-spot) or for pressure-tight joints. (Seam)
SPOT OR PROJECTION WELDERS RAM	Available in large range of sizes to handle all gages	General	Steel, coated steel, stainless, aluminum, brass	Little	Tips Controls	Sometimes	Good	
Single	Most versatile							
Multiple	Faster production of brackets, etc. Accurate locating		Steel	Depends on tooling	Tips Controls	Sometimes	Limited	Jobs must be found to fit the machine.
Guns-on-Ram	Has features of rigs in table for simple jobs				Tips Controls	Sometimes	Good	
MULTIGUN, MULTI-TRANSFORMER Various forms suit different sizes and types of work-pieces, production rates, processing methods, floor spaces, user preferences.	High speed of production. Welds can be close together, will be consistently spaced.	Long-run high production	Steel	None	Tips Controls Hydraulic cylinders and rest of hydraulic system.	Frequently	Limited	Specialized for high production. Change to new product either expensive or impractical. Requires best of maintenance. Usually whole production depends upon one machine.
C-Frame	Simple; accessible. Parts can pass through.							(Stationary Table) (Depends on stroke of "guns" to clear work for loading and unloading.)
Table Stationary Horizontal Sloping Vertical Moving Rising								
Hinged Wheeled	Expensive, but required where large stroke is needed to clear work.							
MOVABLE WELDER (Portable)	Brings tool to large workpiece	Those handling large assemblies	Steel	Definitely	Tips, yoke, cylinder, cable, control	Seldom	At cost of new "gun" (generally small)	Weld quality not of the highest. Requires constant attention.
BENCH AC: capacitor discharge; magnetic force.	Fast, small, safe. Adapted to non-ferrous welding.		Aluminum, copper, silver	None	Tips control	Sometimes	Good	Pressure low in proportion to current; limits applications to steel and other hard metals.

"Electronic controls allow adding of refinements to standard equipment for tough jobs . . ."

selected primarily by its kva rating. Secondly, the other fellow may be paying excessive costs in maintenance, rejects and manhours.

Sufficient electrode force is the first requisite in choosing a machine. That determines the proportions of the whole welder. Match the requirements against machine ratings according to RWMA standards. Allow for the heaviest job, but the one important job should be done in the middle range of air pressure. Do not skimp on machine size, but do not select an oversize welder either.

Determine the welding current required, then add a reasonable amount for uncertainties. Plan to operate at the middle tap for important jobs. Select a transformer with sufficient voltage to produce this current, or specify the current and have the manufacturer furnish the appropriate transformer.

Selection by Current Usage

It is common practice to describe the electrical size of a welder by its transformer kva rating. This is probably done for simplicity, but it can cause trouble for those not familiar with electrical terms. Actually, the transformer kva rating tells nothing except that the machine will carry a certain load under certain conditions without overheating.

Welding current does the job. For standard spot and projection welders, welding current is related to the transformer kva for various throat depths. Therefore, the electrical output of the machine may be specified by transformer kva for specific machine size, throat depth and throat height.

There is no real gain in specifying kva rather than amperes. In fact, there are dangers in the implied use of kva because not only does a given transformer put out different currents under varying conditions, but two transformers of the same kva rating having different secondary voltages will put out radically different currents under conditions otherwise the same.

Timing Control Important

Stress is placed on this point because of the industry-wide usage of the kva rating for labeling welders. This may be convenient for persons understanding the inferences in translating kva into welding current. The best policy is to talk in terms of amperes and allow the manufacturer to supply the suitable transformer for the job.

The two principal electrical controls are the timer which starts and stops the various machine functions, and the contactor which opens and closes the main power circuit in response to orders from the timer.

Originally, timing was done by the operator's eye. This method is outmoded except for occasional toolroom work, or where the machine is used far beyond its capacity and every weld must be hand-nursed.

Motor-driven cams have been used for timing and sometimes for actuating the contactor. They had sufficient accuracy for most ordinary jobs, but were not readily adjustable. Although they were simple, they required considerable maintenance.

The pneumatic timer and mechanical contactor are satisfactory for many jobs, but accuracy tends to vary with time. Their use is mostly limited to the rocker-arm welder and to shops with insufficient electrical equipment to retain qualified maintenance men.

Tooling Should Be Simple

Electronic timers and contactors are the most flexible, accurate and reliable. Trained maintenance men are becoming more available for servicing them. One advantage of electronic controls is that many refinements can be added to standard equipment for doing difficult jobs.

Tooling should be as simple as possible. The exception may be where production is high and tooling can be designed for careful and continuous maintenance, plus accuracy in locating parts.

Every production welding shop must have an air supply maintained at 80 psi at each welder when the shop is in full operation. Surge tanks near large machines which operate intermittently will help to maintain uniform line pressure at all times. The volume of air can be determined if the cylinder size, stroke and number of operations per hour are known.

Water is used to cool all modern resistance welders. A typical machine may require 5 gal per min to cool the electrodes, transformer and electronic contactor. The volume flowing through the machine will depend on size of the water passages in the machine and the line pressure. Water passages should be cleaned regularly to avoid stoppage.

Power Lines Must Be Adequate

Water pressure is not too critical since half the rated volume of water will flow even when pressure is reduced to one fourth the rated value. However, pressure is probably neglected for this reason. Mushroomed electrodes and overheated transformers will usually be found where the pressure at the welder is only 5 psi. At a pressure of 30 psi and an open drain, a reliable welder will withstand any reasonable load.

The electric power supply should be considered before making any commitments for a welding job. If transformers and lines within the plant are large enough, voltage at each welder will remain sufficiently high even when large welders are drawing power. It is sometimes advisable to use a stored-energy welder which draws power from the line steadily.



Joint Effort Promotes SAFETY in Welding

By N. I. SAX
Toxicologist
New York



♦ SAFETY IN WELDING has been an industry-wide effort. Manufacturers of welding equipment, fabricators of welded products, interested agencies and welders have taken an active part in promoting safe practices within their particular segment of the industry. Because of this joint effort, the accident rate among welders has been held low.

Welding setups are of two kinds—permanent and temporary. In permanent setups, the safety aspects are usually worked out satisfactorily. It is in temporary setups that safety is often neglected. Because such setups are intended only for short-time use, they are installed too frequently without enough regard for the welder or those around him.

One of the essentials which leads to safer practice is a better understanding of high-temperature effects on materials. At welding temperature, about 6000°F, metals melt or vaporize and organic materials decompose. Normally stable inorganic compounds decompose to simpler components and many normally inert mixtures become activated to form endothermic combinations.

Air is normally a very stable mixture. If sampled at different points of the earth's surface, its

- ♦ Accident rate among welders is low by comparison with rates of other industries . . . Awareness of safety requirements and an industry-wide effort to reduce accidents is largely responsible for low rate.
- ♦ Common sense, knowledge of equipment and its uses, proper attitudes, and observance of established safe practices are the key points . . . Program includes fire prevention, accident prevention, health protection and safety standards for equipment.

composition will be merely identical. In the presence of welding heat, combinations as ozone, nitric oxide and nitrogen dioxide form in significant quantities.

Ozone is nontoxic in the concentrations emitted from the weld zone. When in combination with oxides of nitrogen, its inhalation will irritate sensitive membranes of the body, particularly those of the lungs, nose and throat. Even in heavy concentrations, exposure is not known to be fatal. However, constant lung irritation may make a person more susceptible to respiratory diseases.

Approved ventilation in a permanent setup will take care of this condition adequately. Temporary installations, particularly those in enclosed areas or tanks, require an effective exhaust system. If the time of the job is short, or if an exhaust cannot be booked up, an air-line respirator should be used.

Most solvents are organic, i.e., they are composed of carbon, hydrogen, oxygen, nitrogen, and often one or more members of the halide group such as fluorine, chlorine, bromine or iodine. These compounds thoroughly decompose when they come in contact with the high heat of welding. Briefly, they form such compounds as hydrogen chloride, cyanides, phosgene, chlorine, hydro-

MR. SAX, author of "Handbook of Dangerous Materials," has had extensive consulting experience in industry and government service.



"Some fluxes when heated to welding temperatures release irritating fumes. . . . These should be removed by exhaust ventilation. . . ."

gen fluoride and others. Solvents containing these substances must either be kept away from welding heat, or the products of decomposition must be exhausted, diluted or otherwise kept from being inhaled.

Before setting up for welding, consideration should be given to whether fumes exist in the area, and if so, what kind. Parts to be assembled by welding are often cleaned with solvents in an area adjacent to that of the welding operation. Sometimes the welder himself uses a solvent to clean the workpiece prior to welding. If the workpiece is wet, or if fumes from the solvent are present when welding starts, toxic materials may be produced. These practices should be banned.

Welding on metals coated with grease, fat or oil can be troublesome. The chief product of decomposition in such cases is acrolein. Unlike some welding fumes, acrolein irritates the eyes and respiratory tract so that its presence is quickly detected and something is done about it. Circulation of air is not very helpful since even low concentrations of acrolein cause general discomfort. Precleaning of work and exhausting the fumes are the most effective remedies.

Another source of difficulty is in welding on work coated with pickling residue, paint, rust inhibitors or other compounds. When heated, these materials produce fumes—some irritating, others toxic. The general rule is to clean the work thoroughly before welding. If the work is not clean,

exhaust ventilation should be used. Personal protection is least desirable since a mask protects the operator but exposes others in the area.

Some fluxes when heated to welding temperature release irritating fumes. These, too, should be removed by exhaust ventilation.

Another aspect of safety is the effect of high welding heat on the metal being welded. Zinc, normally considered quite harmless, vaporizes readily in the welding arc. By mixing with air, the zinc oxide thus formed is so finely divided that it is easily inhaled. Inhalation develops symptoms known as "zinc chills" or "brass founders ague" which are distressing, sometimes sufficiently for the person to require bed rest.

Use care in welding cadmium

Some persons continually exposed to zinc fumes can develop some tolerance for them. However, this tolerance may be lost if exposure is discontinued even for a few days.

Greater care must be exercised in welding cadmium. Its fumes are toxic, producing symptoms resembling those of nitrous fumes or phosgene. An outstanding symptom of over-exposure to cadmium is the formation of a yellow ring around the gums at the tooth line. Any person welding this material should not overlook the use of general ventilation, spot exhaust ventilation and personal protection of the proper type.

Other metals which are about equal in toxicity as cadmium should be handled with the same precaution. These include mercury, arsenic, antimony, selenium, tellurium, chromium, lead and manganese. Their toxicity is roughly proportional to the temperature to which they are heated.

Beryllium is another of the metals which can be toxic in volatile form if not removed from the welding area. Beryllium has many industrial uses, but in welding, it is encountered in small quantities primarily as an alloying ingredient in other metals. As with other toxic fumes, sufficient and proper exhaust ventilation should be provided or the operator should wear a respirator.

Unexpected flash is painful

In all cases, the welder should be told if potentially toxic substances are present in the materials he is to weld. If these substances are present, the setup should be engineered to protect him and those in the area.

Another effect of the welding arc is the emission of actinic radiation, which in combination with welding heat, causes the skin to burn in exposed portions of the body. The welder must protect those areas with proper clothing.

Delicate membranes, particularly those of the eyes, are very sensitive and responsive to radiating effects of the welding arc. An unexpected



Ventilate . . . and keep a fire extinguisher handy.

flash is not only harmful to the eyes, but can be quite painful. The brilliance of an arc attracts a person's eyes to it so that even in a temporary setup a shield should be placed around the welding area. If welding must be done in an unshielded area, persons nearby should be required to wear tinted goggles.

Possibility of fire exists wherever welding is done. Permanent installations do not usually present a problem since combustible materials can be stored away from these areas. It is near temporary installations where special precautions are necessary. Such areas frequently contain combustible materials, flammable gases and liquids, wooden floors and other potential fire hazards.

Asbestos curtain used as shield

Molten particles of metal or slag can roll into cracks and crevices without notice until after a fire has started. Early detection is made more difficult by the helmet the welder must wear. The best precaution is prevention. An asbestos curtain or sheetmetal shield around the welding area will serve adequately in many setups. The curtain should meet the floor, otherwise hot particles will roll under it.

When welding over wooden floors, sand and sheetmetal on the floor, and wetting down of the floors can be used as safeguards. However, the latter two are not recommended when electric arcwelding is to be used. In addition to taking precautions with the setup, a person should stand by with a fire extinguisher during the time when welding is in progress, and for a short time later.

Combustible materials should be removed from the welding area if possible. Materials that are either too heavy or too large to move can be covered with asbestos or other fire-resistant cloth.

Before welding a tank or container, be sure of the substance it contained. If it held a flammable material, thorough cleaning is a must. A water wash will remove water soluble substances such as acid, acetone or alcohol. Immiscible solvents will require a hot alkaline wash.

Inert gases purge vapors

Even after cleaning, a tank may contain small amounts of flammable substance in the seams or crevices, which when vaporized, will accumulate in the tank. Purging the tank of these vapors can be done with carbon dioxide, nitrogen or some other inert gas. Filling the tank with water to a level slightly below the area to be welded is another method which reduces the chance of explosion.

Acetylene is highly combustible over a wide range of concentrations. It will ignite at relatively low temperatures. Keep cylinders away from radiators, stoves or any hot locations. Rough handling of cylinders may damage the cylinder, valve or safety plug and cause leakage. If leakage should occur, the cylinder should be placed outdoors away from any possible ignition source and



Don't let welders keep own solvents on hand.

the cylinder clearly marked to caution others.

The same degree of precaution should be taken when handling calcium carbide or operating an acetylene generator. Storage of calcium carbide should be in approved places only. Water or moisture must not be allowed to come in contact with the carbide anywhere except in the generator. Operation of the generator should be by experienced personnel only. If fire should occur at a generator or near a drum containing carbide, do not use water to extinguish it.

Store oxygen in safe place

Oxygen used for oxyacetylene welding is usually delivered in cylinders charged to a pressure of more than 2000 psi. Storage should be in a safe place where they cannot fall, be knocked over or damaged. As with acetylene, oxygen cylinders must not be stored near radiators, stoves or other hot objects since heat will increase the pressure in the cylinder and burst the seal.

Under no circumstances should oxygen be stored near oil, grease or other such combustible materials. While cylinders are in use, it is well to chain them to a wall, beam, column or similar rigid support to prevent them from being knocked over. In moving cylinders, a hand truck is best. If they must be moved by crane, a cradle or platform should be used. Avoid slings and electromagnets for this purpose.

Oxygen should never be used as a substitute for compressed air. Its use in air-driven tools, for dusting off work or clothing, and for providing ventilation can be dangerous. Clothing saturated with oxygen needs only a spark to start a fire.

Hoses and hose connections for oxygen should be of an approved type. Both must withstand the high pressures to which they are subjected. Proper connections fastened securely will prevent leakage. Pipe compounds should never be used to make an oxygen or acetylene connecting leak-proof.

Oxygen regulators are intended only to deliver oxygen to the job at the proper pressure. They



"The housing of welding machines should be grounded to protect the operator. . . ."

should never be used for other gases. The same applies to acetylene regulators. When regulators and hoses are connected securely, open the cylinder valve slowly and stand aside from the face of the regulator dials. A sudden surge of oxygen into the regulator at extremely high pressure may damage the regulator mechanism.

In lighting a torch, follow the instructions recommended by the manufacturer. The proper method of lighting a torch may sometimes vary with different torches. In lighting the torch, use a friction lighter or a fixed pilot flame—never a match.

Electric arcwelding equipment has been designed to incorporate as many safety features as practical. Nevertheless, there are certain exposed parts on virtually all electrical welding equipment which should be avoided. The open-circuit voltage of most equipment is relatively low and is not normally dangerous. However, when the operator's body resistance is low and he is perspiring or standing on a wet surface or metal plate, a shock can be harmful. Moreover, the involuntary muscular actions of the body may cause an accident of a more serious nature.

The flame, case or housing of all welding machines should be grounded. This protects the operator from the full potential load of the machine in the event that a short should occur in it. Grounding is seldom a problem in a permanent setup, but is sometimes overlooked in a temporary setup. The insulation of a machine breaks down rarely, it is best to ground the machine as an extra precaution.

Cables and accessory equipment supplying power to the electrode holder should be of adequate size and approved type for the current to be carried. Cables should also be of continuous length since poorly insulated splices expose the operator to the possibility of shock and fire.

Worn or damaged cables should either be repaired or discarded. In disconnecting cable, be sure the power supply is shut off. Extra care in temporary setups will avoid the possibility of getting the welding cables mixed with the power supply cables which normally carry a 220-v or 440-v potential.

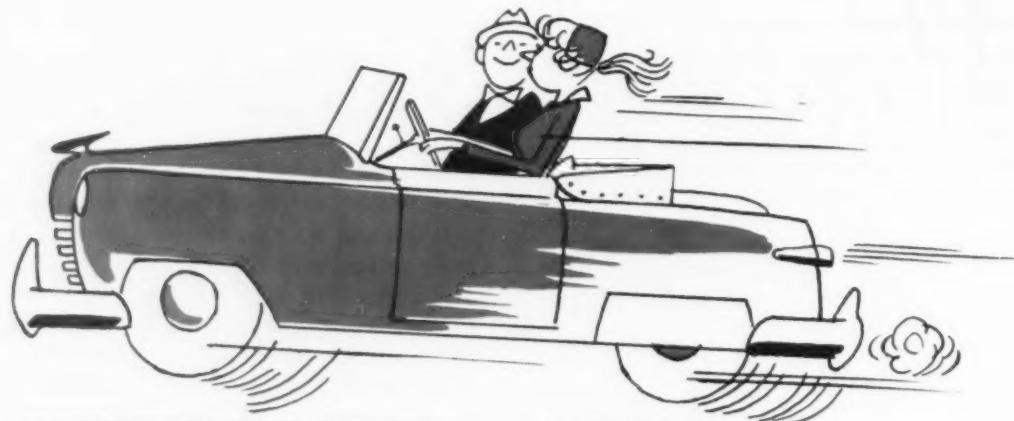
Good housekeeping and common sense are probably the two most important factors in safe practices. Because most electric welding equipment is designed for an open-circuit voltage of 80-v or less, unnecessary liberty is often taken with the equipment. When equipment is not in use, the main power supply should be shut off.

Protective clothing is required to safeguard against burns from hot metal particles and from arc radiation. The amount of clothing and type depends on the nature of the welding operation. It should not contain pockets, or cuffs which could entrap metal particles. If clothing has pockets with flaps, they should be buttoned.

For overhead welding, a skull cap and shoulder pads should be worn. Leather jackets and aprons also give additional protection. Half shoes will not keep hot metal or slag from getting into them and should not be worn.

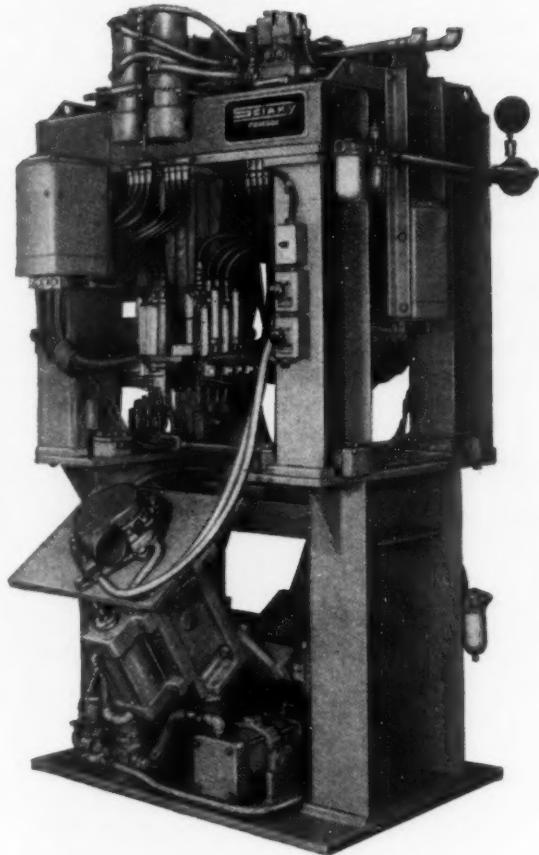
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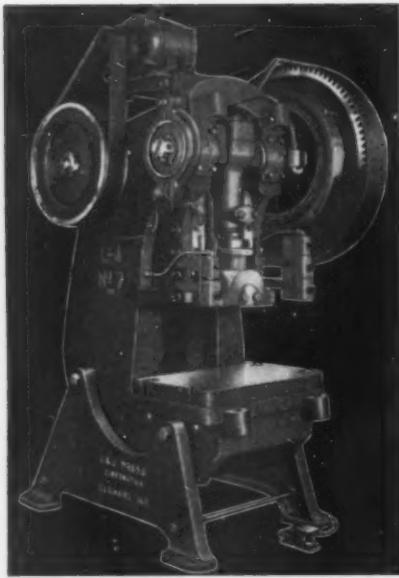
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Welding Briefs

ATOMIC ENERGY: Paducah Stars Welding

Training of welders and organization of fabricating shops play big part in building Paducah Area Project . . . Special methods cut production time.

Rapid progress in building of the \$1 billion gaseous diffusion plant for the Atomic Energy Commission at Paducah, Ky., is due in large part to the skillful organization of special fabricating facilities and careful, rapid training of qualified welders.

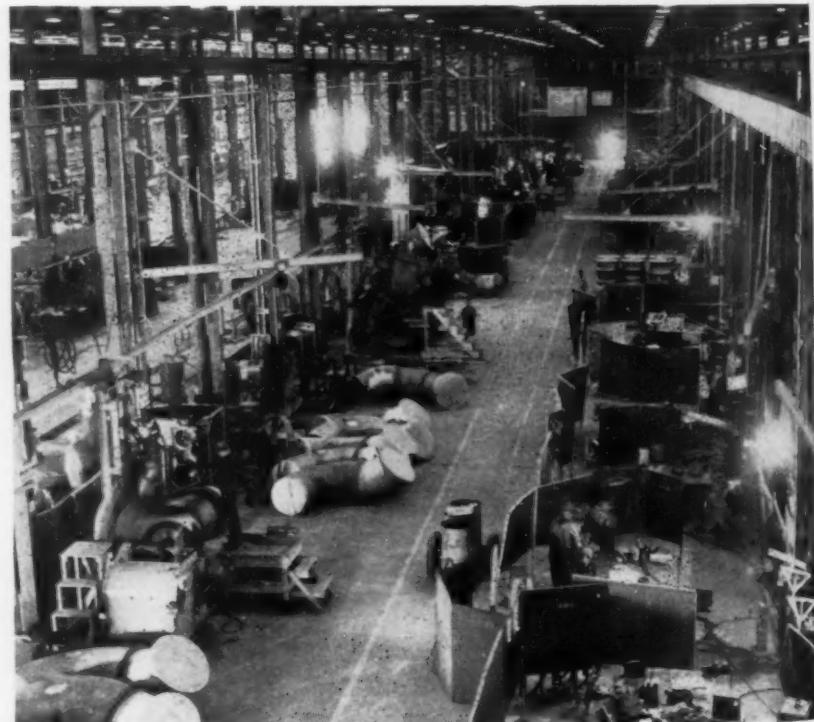
The big plant, now 70 pct completed, is expected to be in operation some time in 1955. Special shop facilities required to speed construction and installation of piping and equipment were built by F. H. McGraw Co., New York.

One of the prime needs of fabricators working at the project has been for thoroughly qualified welders. It is estimated over 450 tons of welding rod will be used. The supply of welders familiar with the metallic arc carbon steel welding operations was sufficient to maintain the construction schedule in its early phases.

IF YOU WANT MORE DATA

You may secure additional information on any item briefed in this section by using the reply card on page 109. Just indicate the page on which it appears. Be sure to note exactly the information wanted.

As construction progressed, however, it became evident that normal employment procedures could not procure welders in sufficient quantity to maintain the construction schedule required when the mechanical phases of the job became predominant. Toughest problem was to obtain a large number of welders with an alloy welding background.



Pipe fabrication shop at Paducah Area Project . . .

and Production Ideas

Due to the complexity of the mechanical systems and the quantity of alloy welding required, it was necessary to establish a training center. Sufficient welders with the necessary background in alloy welding who were able to pass test requirements of the Atomic Energy Commission and the architect-engineer firms were not available.

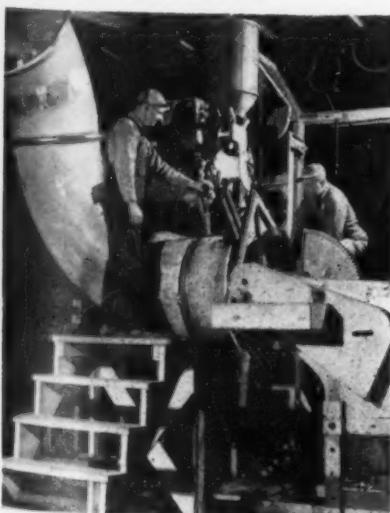
Training Center Set Up

To solve this unusual manpower problem, a welder training school and qualification testing laboratory was established. Qualified men were assigned from various participants and subcontractors to serve as instructors and to help supervise the activities of organizing the overall program and conducting the training school.

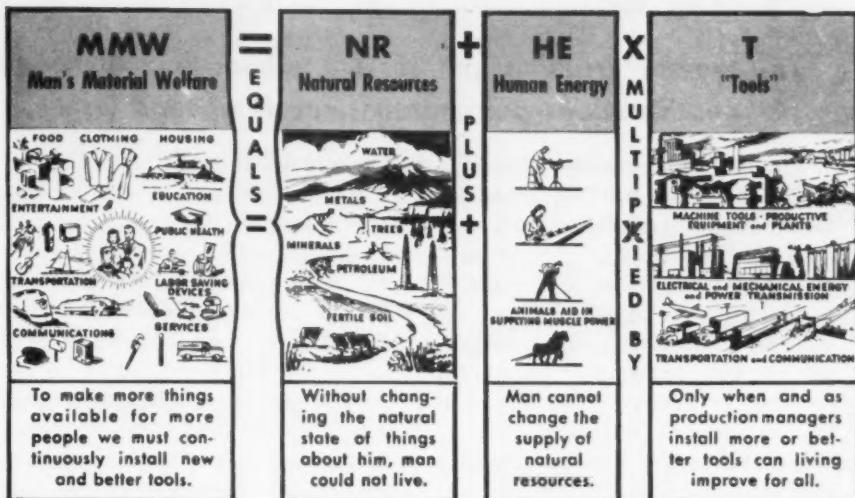
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Fixture for ducts . . .



Help for positioning . . .



No 40-Hour Week In China

If a 40-hour work week were legislated in China, a great many Chinese would starve. A Chinese worker cannot produce enough to supply life's necessities in so few hours. Before World War II, China used nearly 75% human energy and only 25% mechanical energy to produce its goods. The United States used only 2.1% human energy and 97.9% mechanical.* The ratios cannot have changed too greatly in recent years.

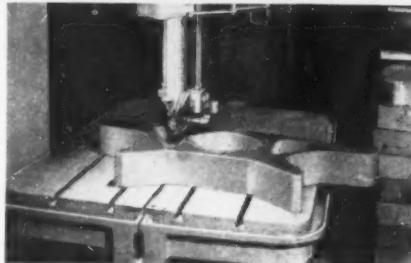
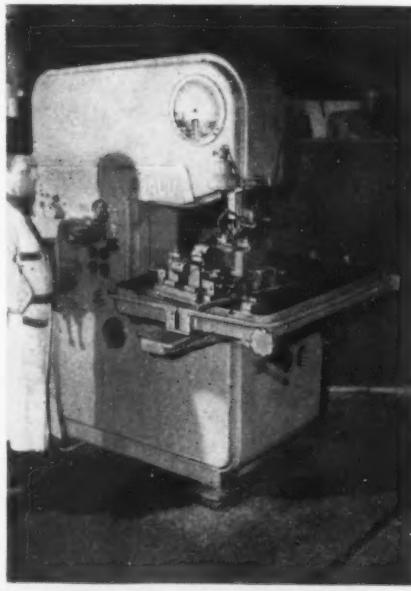
The mass of people in China have a standard of living far below the level of that in the U. S. 100 years ago.

Our ability to produce and consume over one-third of world's goods and services while having only about one-sixteenth of the world's land, resources and population is mute testimony to the advantages of our economic system. Under it a man has freedom to think, do and own. He can count on reward for initiative, originality and effort. He can dream of, and expect to get, more while working less hours. These freedoms have enabled us to create and use more "tools" than any other nation. This in turn has created time for new freedoms of leisure, travel, enjoyment and education.

No other system has done this.

How can "tools" so free man? The accompanying illustrations show intricate shapes cut in metal with a DoALL Band Machine. The cutting tool used is an endless, narrow saw band which cuts continuously. Millions of such parts are cut easily and rapidly by thousands of band machines in use in the U. S. No other stationary power tool can begin to do the wide variety of jobs that a band machine can do. This is typical of development of tools in the U. S. to take the place of human energy.

DoALL also produces precision surface grinders and gage blocks and accessories. Through a network of 38



DoALL BAND MACHINE sawing aircraft forgings, using special fixtures. Inset shows another typical job.

DoALL stores it also sells a complete line of cutting tools, tool steel, gages and other specialties. Headquarters is The DoALL Company, Des Plaines, Ill.

*Source: National Industrial Conference Board: "America's Resources for World Leadership," 1947.

DoALL

FREE ON REQUEST for your bulletin boards: 17" x 22" wall chart "Why Living Improves in America."

The welder training and testing school has averaged 147 qualifications per month since it opened . . .

The training program consisted of the following welding qualifications: Welding of nickel lined steel pipe by the metallic arc method; welding of Monel pipe by the metallic arc and Heliarc method; welding of Inconel by the ac Heliarc method; welding of aluminum by the ac Heliarc method; and the welding of stainless steel by the metallic arc and the Heliarc method.

Welding of dissimilar metals required the operator to be qualified to weld Monel to carbon steel by the metallic arc method, Monel to carbon steel by the oxy-acetylene brazing method, and the brazing of copper to steel by the oxy-acetylene method.

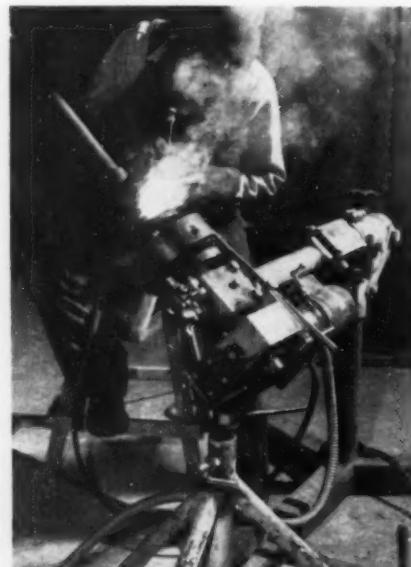
Silver Brazing Included

Dissimilar metal training also included silver brazing techniques which are used extensively for pneumatic instrumentation work. This silver brazing involves the use of alloys containing up to 70 pct silver.

The problem of securing qualified instructors to provide adequate instruction in the above welding methods was difficult to overcome. At the outset, enough men were assigned from the staffs of various participants at the project to start the program, although there was a serious handicap due to the lack of sufficient quantity of instructors qualified to teach the

various welding methods.

It was found that the welding operator with the greater number of qualifications was a greater asset to the construction program. It was determined that the most effective method of obtaining a large number of welders who had passed several qualification tests would be to keep some operators in the training school until such time as they would be able to successfully pass at least three to four different qualifications prior to release to the construction forces.



Rotator turns part . . .

In addition to the manpower problems, many technical difficulties were encountered and solved through joint effort by the interested participants.

Technical Problems

Development of the submerged arc method for welding pipe of various diameters and types of joints, required a great deal of technical study. This method is now being successfully used in the welding of nickel lined pipe, standard steel pipe, and plate rolled pipe.

Also, there were problems of welding large pipe, to 60 in. in diam and 7/16 in. wall thickness, by automatic machine methods.



Hole cutter at work . . .

Special devices were used to automatically cut the ends of large pipe in preparation for welding.

As of March, 1953, a total of 5579 qualification tests had been performed out of which 3230 were qualified. The above figure indicates that successful qualifications resulted from 58 pct of the tests performed. After deducting for absenteeism and turnover this total provided sufficient qualifications to meet the construction requirements without serious delays.

Standards and Results

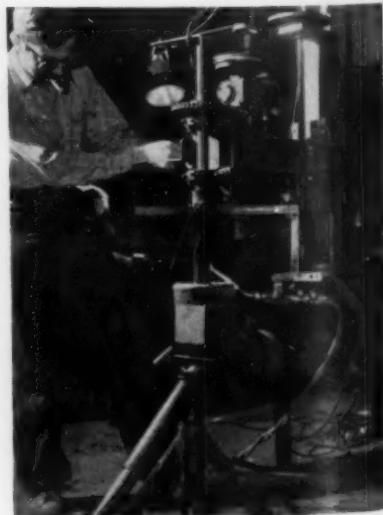
All welders were required to successfully pass the carbon steel metallic arc, the oxyacetylene, or the silver braze test at the time of hiring in. This practice made available men who were familiar with standard carbon steel welding or silver braze techniques, and gave the school a start.

In the 22 months the welder training and testing school has been operated there has been an average of 147 qualifications per month.

Due to the large quantity of sheetmetal work of special construction which had to be fabricated and installed throughout the project in a short time, special low cost, rapid production methods were needed.

Studies indicated the best organization would be a single group which would make shop drawings of components, manufacture these items, and then make the instal-

Turn Page



Trims fittings . . .

NEW

automatic welding
without shake or shimmy

THE PANDJIRIS WELDING HEAD MANIPULATOR

IT PILOTS YOUR WELDING HEAD!

... welds are smooth and even! Reason: Machine tool accuracy in all moving parts; it's rigid... it's compact.

MORE VERSATILE—adapts to any weldment

- 1 Power car moves *up or down* track at selected variable welding speeds. Rapid traverse return.
- 2 Boom travels *in or out* at selected variable welding speeds. Rapid return.
- 3 Boom moves *up and down*. Head lowers to floor level.
- 4 Mast with boom rotates 360° on power car.
- 5 Welding head swivels 180°.

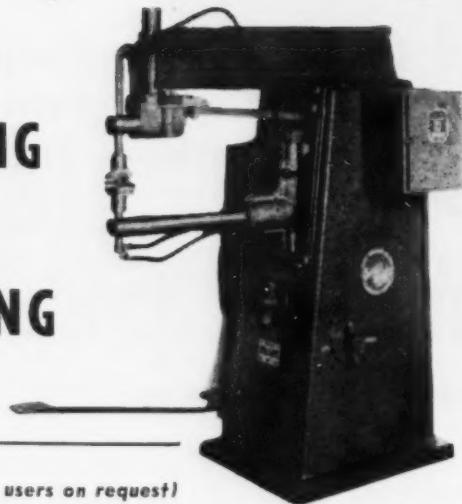
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CASE HISTORY 1 (names of users on request)

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CASE HISTORY 2

Very much pleased with Type PTW-75 Automatic Chair Welder in operation approximately two years, welding frames of our chromium-plated dinette chairs. Getting very satisfactory job at substantial savings and practically no maintenance problems.

CASE HISTORY 3

In constant operation since it was installed, cost per chair frame a negligible factor in overall cost. Welder has made it possible for us to offer a product without ugly welding marks. Customers well pleased.

CASE HISTORY 4

Since installation of chair welder, producing approximately three times as many chairs per day with half personnel. Cost of welding cut two-thirds.

CASE HISTORY 5

Ames Spot Welding Company has developed resistance chair welder now being used by all leading producers of chrome. Makes weld not noticeable, does not corrode, does not break plating, eliminates usual rust at ugly welding surface. Production as well as quality increased beyond expectations.

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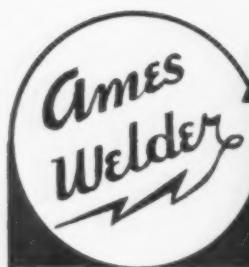
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Welding Briefs

"A team of expert sheetmetal supervisory men was assigned to the job."

lations throughout the project. Sheetmetal shop services were also needed by various departments and crafts on the job.

A team of expert sheetmetal supervisory men was assigned to the job, and a temporary shop set up and placed in operation. This shop was later expanded into a complete sheetmetal factory with shop drawing service, pattern making service, and field installation service.

This setup provides under a single administrative head a closely integrated group capable of handling all aspects of sheetmetal work and quickly applying design changes and resolving field installation problems.

Weekly Output High

Sufficient equipment was installed in the shop to permit manufacture of the great variety of sheetmetal components required and to render general sheetmetal fabrication service for special requirements throughout the job.

The shop occupies approximately 65,000 sq ft of floor space and can turn on up to 200 tons per week of finished sheetmetal products, depending upon the field requirements.

The result of operating this facility has been that large volumes of high quality special sheetmetal work were fabricated and installed in short periods of time at a minimum overall cost.

Unusual Techniques Developed

Throughout the shop many techniques are used which are somewhat unusual on a construction job. Some of these techniques (which were worked out and applied from practical ideas set forth by both workmen and supervisors) are described on the following pages.

Patterns for sheetmetal parts are carefully laid out on tough fiber paper to show cut and bend lines for the work. The pattern layout room is adjacent to a draft-

Turn to Page 189

THE IRON AGE

Welding Briefs

ing room where shop drawings are made.

Stored For Reorders

Locating draftsmen near pattern layout men has resulted in an efficient transfer of information between these two groups. Completed patterns are turned over to the shop where they are used to transfer cut and bend reference points to the metal.

Due to repetitive design, a pattern can be used to make many parts. After all sheetmetal parts for a specific installation have been marked, patterns are then stored for possible future use on reorders.

Tools For Punch Press

It was found that there were many requests for special small parts that could be made on a punch press. To satisfy this need for special service to the construction operations, requirements for new parts were referred to the sheetmetal shop where shop drawings of such parts were made. The necessary tools and dies were developed and parts made on the press.

The results of this activity are prompt service to various groups throughout the project in furnishing many special parts in a short time at a reasonable cost.

Adjustable Welding Fixture

It was necessary to fabricate a large quantity of welded duct sections of various dimensions. In many cases interchangeability of units of a particular design was required.

Special adjustable fixtures were



Fabrication shop . . .



Pipe cutting gadget . . .

designed and constructed to facilitate welding and to provide a means of positioning and aligning the components of welded assemblies. Each fixture consists of two rotary plates for attaching the flange end of sheetmetal assemblies.

Plates Pivot On Frame

One of the rotary plates is pivoted on the stationary frame of the machine. The other plane is mounted on a movable support which runs on a track on the stationary frame and is adjusted by means of a crank operated screw to provide for varying the distance between the plates to accommodate different items of work.

The plates have a variety of radially slotted holes and a number of conventional round holes through which bolts with special clamps are inserted to allow clamping work of different sizes and shapes to the face of the plates.

Exhaust Fan Included

Work is placed between the plates, leveled up, tack welded in place, and then the work is rotated by hand to accommodate manual welding operations. An exhaust fan is provided at the top of the welding fixture with an appropriate duct to exhaust smoke and gas generated during welding.

This fixture is a convenient means for aligning the work while it is being welded, and it provides an easy means for rotating the work while welding.

Turn to Page 198

P&H

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4. Greater arc stability.



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The photo tells the story! The ordinary tungsten rod lost 2 inches in four hours. But ZIRTUNG, on the same job in the same time, lost only $\frac{1}{2}$ an inch!

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This time-saving, money-saving rod is an amazingly improved tungsten-zirconium alloy, developed exclusively by Sylvania for inert gas electric arc welding. Operates in the same current ranges as thoriated tungsten. And it contains no radio-active material.

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A midwest manufacturer was faced with the problem of getting X-ray quality welds in aluminum vessels. These welds were subject to pressure and had to be entirely free from porosity and oxide inclusions. After thoroughly investigating customer specifications, LINDE's service engineers recommended HELIARC inert gas shielded welding for the job.

Since then, about a half mile of these HELIARC welds have been OK'd by 100% X-ray inspections. According to company officials, HELIARC welding was "perfect for the job" and meant real savings by getting X-ray quality welds the first time without expensive rejections or repairs.

Whether you weld aluminum or other hard-to-weld metals, you, too, will find that fast, clean, HELIARC welding will save you time and production costs. HELIARC welding takes place under a shield of inert argon gas which eliminates the need for flux. As a result, HELIARC welds are free from porosity and oxide inclusions. This means fewer rejects and lower finishing costs. In fact, spatter-free HELIARC welds in many cases can be left "as welded."

You owe it to yourself and to your Company to find out more about the cost saving benefits of HELIARC welding. Call your local LINDE representative today. He will be glad to furnish you with detailed information on HELIARC welding.



LEFT Welding heavy aluminum sections with HELIARC HW-10 torch. These welds were strong, dense, and required little finishing. *BELOW* The 300 amp. HELIARC torch has all-internal water-cooling of both torch head and power cable for cool, long-lasting operation. The HW-10 also features quick electrode adjustment.



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Welding Briefs

Gaseous diffusion plants involve large quantities of piping for handling gases and solutions . . .

A great portion of the shop effort is devoted to production of large duct sections reinforced by structural steel frames. To provide interchangeability and for supporting and aligning the work during fabrication, several large assembly fixtures were designed and constructed.

This type of fixture was found to be very effective in maintaining

interchangeability and in attaining a rate of production to meet field requirements.

When an individual or group in the field needs a special sheetmetal item, it is referred to the shop. If the item or idea is feasible, the sheetmetal shop designs the product requested, makes the necessary tools for production, and produces the required quantity.

A group of models of selected sheetmetal items has been made for use as instruction aids. The models are being used to impress upon the responsible shop personnel the intricate requirements of some components and to guide them in their shop work. The models are also used to instruct installation crews.

Reference to these models, particularly during the initial phases of production of an unfamiliar item, is very helpful in resolving production problems.

A clear understanding of the requirements for each part is invaluable to the workmen in carrying out their work. Also, this visualization of the end application of components contributes to the high morale and enthusiasm exhibited by the workmen in this shop. The models are very helpful in explaining points quickly to shop field men.

Pipe Fabrication Shop

Gaseous diffusion plants and associated facilities characteristically involve large quantities of various sizes of piping for handling gases and chemical solutions. The principal piping materials involved are low carbon steel, stainless steel, Inconel, and Monel, as well as nickel lined low carbon steel pipe. Sizes vary up to 54 in. in diam.

While a large portion of the process pipe fabrication work is being performed off the site by a vendor, it was necessary to set up a pipe fabrication shop to fabricate some of the special process piping and to assemble fabricated sections furnished by the vendor.

Establish Local Group

Due to the extremely large volume of piping and the need for a large number of qualified piping personnel at the site, F. H. McGraw & Co. negotiated a subcontract with The M. W. Kellogg Co. to cover operation of the pipe fabrication shop, cleaning of fabricated assemblies, and installation and testing of process piping prior to acceptance by the operating contractor, Carbide & Carbon Chemical Co., a division of Union

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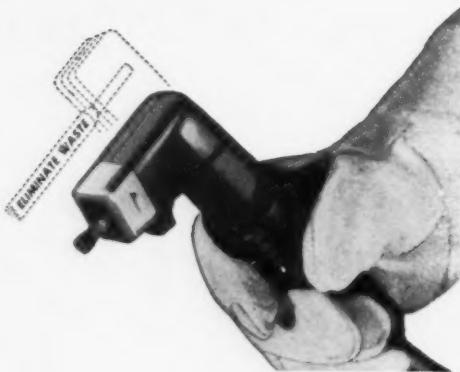
THE IRON AGE

BERNARD

PIONEER FOR MODERN WELDING



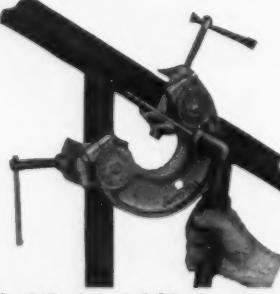
The jaws substitute for stub waste by splicing a 2 inch extension to the length of every electrode.



Delivers FIVE surface cleaning blows with each swing and lasts FIVE times longer than single headed hammers.



MODERNIZE the fabrication of plates, shapes, rods, bars, pipes, etc. MAKE fitting, positioning, holding, and welding a fast, accurate, inexpensive, one-man job.



See your Local Dealer, or, Write For Bulletins, SS-3, MP-6 and PCB-6

Mfg. by

BERNARD WELDING EQUIPMENT CO.

10218 AVENUE N. CHICAGO 17, ILLINOIS

Two important parts of

UNIONMELT WELDING

Trade-Mark

You Can't See

This is UNIONMELT welding—instantly recognized by the special granulated material you see blanketing the weld. *You can't see* the powerful electric arc that fuses the metal beneath at the highest production rate attainable. No sparks or glare disrupt nearby plant activity.

You can't see the LINDE SERVICE that stands behind every UNIONMELT installation to assure its efficient and profitable operation. Only LINDE can give you this unique combination of research, engineering, and over 40 years of welding know-how that is helping LINDE customers save money and improve production. And only LINDE can give you the accumulated benefits of more than 18 continuous years of development, field testing, and improvement in the field of submerged melt welding where it pioneered.

LINDE'S Service Engineers will gladly help you design a UNIONMELT installation to meet your exact requirements. They will also be available to help you when a tough production problem comes up. Call your nearest LINDE representative today.

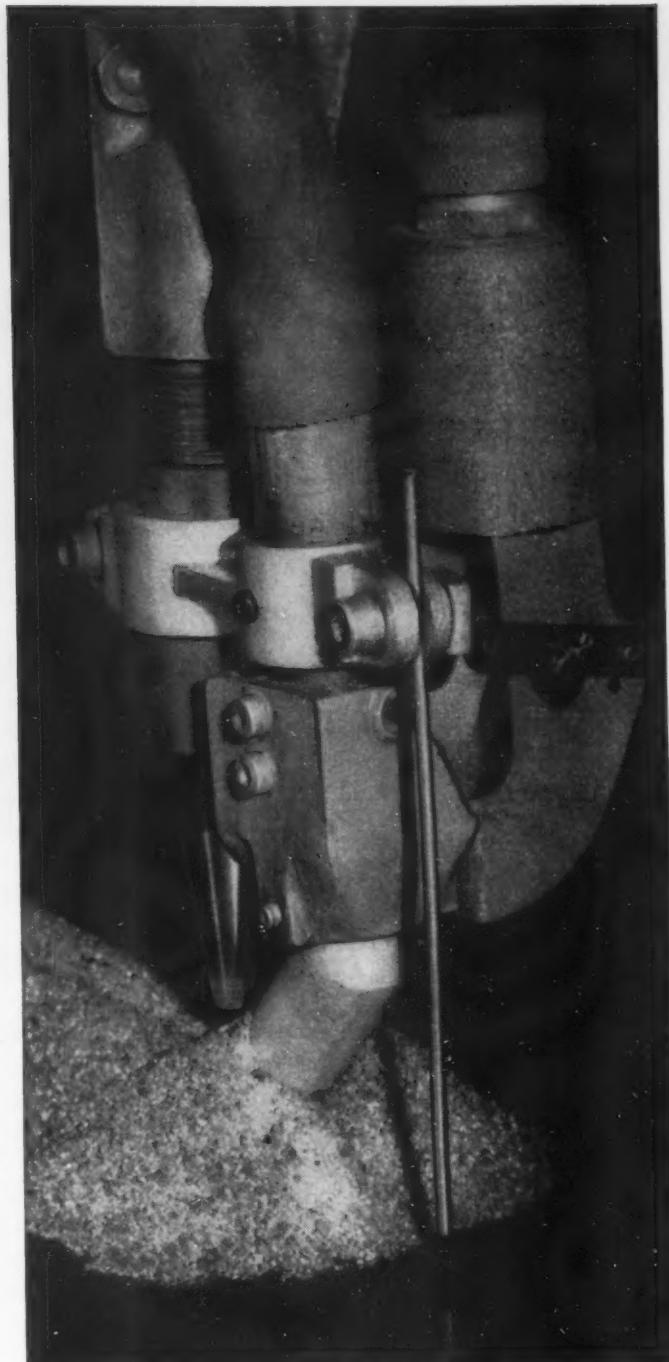
LINDE AIR PRODUCTS COMPANY

A Division of Union Carbide and Carbon Corporation
30 East 42nd Street  New York 17, N. Y.

Offices in Other Principal Cities

In Canada: DOMINION OXYGEN COMPANY, LIMITED, Toronto

The terms "Linde" and "Unionmelt" are registered trade-marks of Union Carbide and Carbon Corporation.



Linde
TRADE-MARK



How to get welds with high fatigue strength

To get the least weight per horsepower in diesel locomotives calls for the light weight and strength of low alloy-high tensile steels. Welded fabrication of this steel demands joints that possess high fatigue strength to resist the pounding and vibration of steady operation.

The rigid quality controls of Arcos Low Hydrogen Electrodes that assure the locomotive builder the needed weld metal physicals, give you the same assurance of consistently high physicals on any low alloy-high tensile welding job. *Regardless of the nature or requirements of the job, when you specify Arcos Low Hydrogen Electrodes you'll get the results you want . . . plus the added saving of time, in many cases, of being able to eliminate preheat and to weld in all positions with one electrode.*

ARCOS CORPORATION
1500 S. 50th Street, Philadelphia 43, Penna.

ARCOS GRADE	A. W. S. SPEC.
Tensilend 70	E7016
Tensilend 100	E10016
Tensilend 120	E12015
Manganend 1M	E9015
Manganend 2M	E10015
Nickend 2	E8015
Chromend 1M	E8015
Chromend 2M	E9015

**WELD WITH
ARCOS**

LOW HYDROGEN ELECTRODES

Welding Briefs

Carbide & Carbon Corp., New York.

The shop building covers approximately 85,000 sq ft of floor space. It contains storage space, a machine shop, bending, welding, and other pipe fabrication facilities. The equipment also includes overbend traveling cranes, jib cranes and mobile hoists for transporting pipe in the shop.

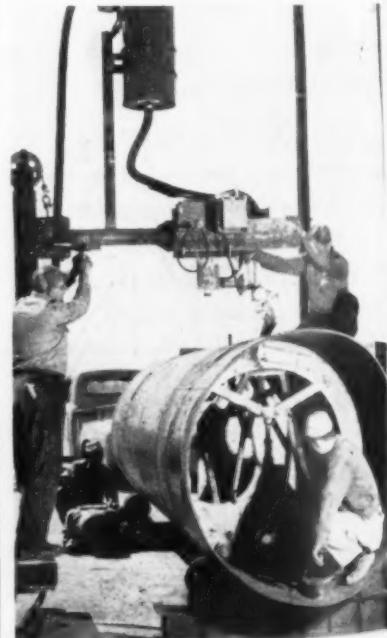
Cascade oxygen storage and an acetylene generator are used to supply gases to the cutting and welding equipment. The gas is piped to various stations in the building to eliminate handling of bottles.

In the shop, manual arc, submerged arc automatic, and manual Heliarc welding operations are carried out, as well as oxyacetylene gas welding and cutting. Low temperature brazing and silver soldering operations are also carried out as required.

Practical Ideas Pay Off

Due to the large volume and special requirements to be met in fabricating the process piping, a number of interesting techniques are being applied in the pipe fabrication shop operations.

These assure high quality workmanship, keep fabrication costs to a minimum, and allow the tight



Power spin for pipe . . .

Welding Briefs

Special machinery used to speed welding operations.

schedules to be met. Some of these techniques, which resulted from practical ideas of various workmen and supervisors, are described below.

Special Welding Machine

To carry out the welding of large quantities of different sizes and shapes of large nickel lined pipe sections, a number of special automatic welding machines were constructed.

These machines are automatic and perform a multi-pass submerged-arc welding operation. After the pipe is welded, it is cleaned in a separate cleaning building which is a part of the permanent facilities. Then each pipe section is inspected.

After exterior painting (except for welds), the pipe is installed in the process buildings under strict cleanliness control conditions, and each system is tested under high vacuum for tightness.

Automatic Hole Cutter

A special automatic hole cutter was devised and used to cut holes in the side of pipe in preparation for welded "T" or angular branch joints. The cutting torch is mounted on an arm that is rotated and position controlled by a cam activated linkage.

The linkage causes the head to follow the desired hole contour on the pipe as the head rotates. A different cam is used on the machine for each different pipe size and hole contour.

Work Rotating Device

It was found that many hand welding jobs required the work to be supported on an angle and rotated. To meet this requirement, a chuck was mounted on an angle and a special device was provided to rotate the chuck in either direction. A foot switch is used.

This device provides a convenient means of supporting and rotating the work. A special automatic pipe end cutter was devised and used to prepare the ends of pipe fittings for welding.

Turn Page

December 10, 1953



For sound welds in high temperature, high pressure service...

When you have a welding job that calls for weld metal of high strength with excellent properties at elevated temperatures, you can trust ARCOS STAINLESS ELECTRODES to give you the results you want.

Whatever the requirements, Arcos Stainless Electrodes provide a wise investment in time and money. From the extensive line of Arcos electrodes, you can choose the electrode to produce a weld with required physical, chemical, or metallurgical properties to stand up in service. Get your free copy of "What Electrode Would You Use?" Write today!

ARCOS CORPORATION, 1500 South 50th
Street Philadelphia 43, Pennsylvania



**WELD WITH
ARCOS
STAINLESS ELECTRODES**

**Reducing a 12-day job to
2 days . . .
with the
ARCAIR
TORCH**



ARCAIR cut labor costs more than 80% on a recent job for Seidelhuber Iron & Bronze Works of Seattle, Wash., removing mild steel welds in one-sixth the time required with a chipper.

A change in requirements on three steel trash racks being built for McNary Dam left Seidelhuber with the job of removing 167 cross members on each rack. These cross pieces were triple welded with 4½ inch double fillet welds.



Two men with a chipper took three full days to strip one rack, plus the help of an extra man sharpening chisels. The remaining two racks were stripped by one man using an ARCAIR Torch. The job was completed in two days at a labor saving of 80 man-hours.

In addition to the time saved in actual removal of the welds, the job done by the ARCAIR Torch required far less grinding to prepare the surface for rewelding. The ARCAIR method slashed operating costs too . . . expenses amounted to \$8 worth of electrodes plus the operation of a welding machine and air compressor.

Said the leadman on the job, "The ARCAIR Torch is faster than any other method I know of for leaving a smooth surface with little grinding. It's worth the expense even for one job."

Write for Free Bulletin with facts and photographs of other time and money-saving applications of the ARCAIR Torch. Arcair Company: EASTERN DIVISION, 423 So. Mt. Pleasant Ave., Lancaster, Ohio; WESTERN DIVISION, P. O. Box 4107, Bremerton, Wash.



Cuts all metals—using only electric arc and compressed air

Welding Briefs

The work is aligned and clamped in the device. The cutting torch is mounted on an arm and rotated by a motor drive while the cutting takes place.

Cleaning Device

A special pneumatically operated cleaning device was constructed and used to facilitate the mechanical cleaning of the inside of long pipe sections.

Cleaning is accomplished by wire brushes mounted on a special head. These can be adjusted to accommodate different pipe diameters. The head is driven by a shaft which is intermittently supported and connected to a pneumatic motor mounted on a carriage that rolls on the floor.

The carriage is moved back and forth to insert and withdraw the wire brush assembly through long sections of pipe. The device is used to clean pipe up to sixty feet long.

Instrumentation Shop

Large numbers of pneumatic instrumentation systems were required in the various process buildings. It was found economically feasible to prefabricate a number of instrumentation assemblies prior to installation. A special shop was set up to perform this prefabrication work.

Numerous instrument racks are fabricated, assembled with tubing, tested, and sent to the plant buildings for erection. Valve assemblies and connections are fabricated and tested and sent to the building for installation.

Floor space of the instrumentation shop is approximately 20,000



Test coupon file . . .

Turn Page

**ANNOUNCING
The NEW AMES
BANDSAW WELDER**



Larger Capacity, Portable Combination Butt Welder.

**Capacity: 3/4" Saw Blades
3/16" Wire**

Complete Instructions on Name Plate enable inexperienced operators to get perfect weld every time.

CONSTRUCTION AND SPECIFICATIONS

Welding jaws are ruggedly constructed of solid copper. Unit is housed in a welded steel case with long-lasting grey wrinkle finish. Overall dimensions 7½" x 12" x 7". Weight 31 lbs. Supplied with handle for easy portability. Operates on 110 volts A.C. 60 cycles. An 8-foot cord and plug make the AMES WELDER instantly ready for any welding job within its range.

This low cost, compact and fully automatic welder is an all-purpose unit designed to handle practically all requirements of the user.

Due to its wide range, the AMES WELDER is particularly useful on internal tool and die work. Its complete welding facility for all types of band saw blades reduces filing time tremendously, cutting, as it does, so close to the line. It is fast becoming a necessity in every metal-working shop. Simplified controls assure uniform results at all times, even with inexperienced operators.

The built-in grinder, designed to remove flash from the weld, and the double gauge for checking thickness of weld on flat saws, are two additional top features of this well-designed band saw welder. Because of its portability, it is possible to service a battery of band saws. Removable back plate facilities permit permanent installation when desired.

Partial List of Distributors

Brooklyn, N. Y.	Hansen & Hale
Newport News, Va.	Noland Co., Inc.
Seattle, Wash.	Star Machinery Co.
Los Angeles, Cal.	Given Machinery Co.
Atlanta, Ga.	J. M. Tull Metal Supply Co.
New Haven, Ct.	Botwinik Bros., Inc.
Philadelphia, Pa.	J. A. Cunningham Equip. Inc.
Fort Worth, Texas	National Welding Supply Co.
Chicago, Ill.	Dobberg & Danits
New York City	Federal Machinery Co.
Greenfield, Mass.	Jaeger Welding Supply Co.

For your nearest distributor, write us.

AMES SPOT WELDER CO., INC.
1328-1330 58th St., Brooklyn 19, N.Y.



Always the top weld grinding wheels, the new Norton Reinforced Hub Wheels — the Rigid BD and the Semi-Flexible BFR — now accentuate the profit-building "Touch of Gold" with greatly improved performance.

NOW...better than ever!

New improvements in Norton BD and BFR wheels for weld grinding

add greater value to the "TOUCH of GOLD"

The story behind the new Norton BD (Rigid) and new BFR (Semi-Flexible) Reinforced Hub Wheels is a striking example of Norton's never-ending product development.

Already top performers over the widest range of weld grinding jobs, these two popular wheels have been re-designed for even greater popularity. Advantages like the following tell you why:

The rigid BD wheel. A new outside layer of cutting material enables the BD wheel to cut on both sides — and to start cutting the instant it touches the work, eliminating the need for "breaking-in." In addition, increased strength and durability and faster cutting action make it the ideal weld grinding wheel for heavy stock removal. It is also excellent for notching gates and risers on castings.

The semi-flexible BFR. New construction provides greater durability, for longer service life, plus faster cutting rates. Other features for stepped-up performance include: more uniform grinding action from wheel to wheel and lot to lot; stronger bonding and improved cutting-off action. Combining fast cutting with safety, the BFR is unequalled for your lighter weld grinding applications.

*This new "Touch of Gold"
is job-proved*

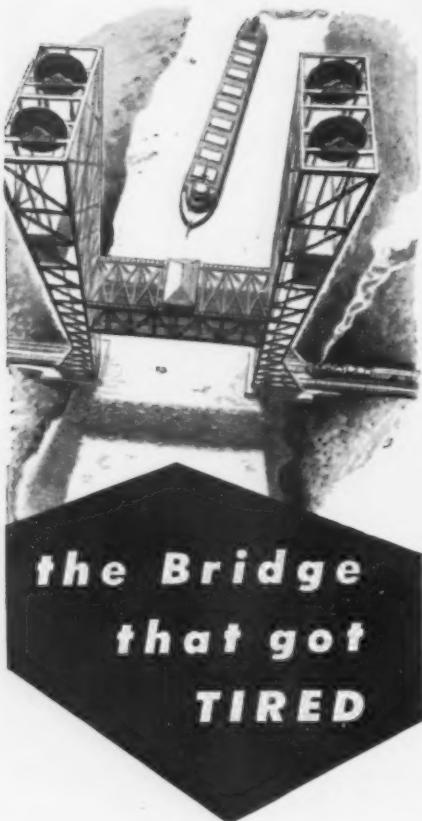
In field test after field test, these stronger, faster-cutting BD and BFR wheels have outlasted and outperformed the best that competition can offer. So, once again you have the famous Norton "Touch of Gold" in action — producing better results and cutting costs in the

grinding jobs you're doing right now. For complete facts, see your Norton Distributor. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed in your classified phone directory under "Grinding Wheels." Export: Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

W-1528

NORTON
ABRASIVES

*Making better products...
to make other products better*



Vital cable wheels that lift this bridge developed what engineers call "fatigue" cracks. Although too small to see, these cracks could cause sudden, disastrous failure!

The wheels were inspected in place with Magnaflux*. It spotted these cracks—just as it spots cracks in parts, metals and other materials on the production lines of a thousand and one industries!

By detecting these invisible defects (during maintenance or in manufacture), the modern inspection methods of Magnaflux are helping practically every kind of business to produce better products with more profit. They are low in cost and non-destructive. They are so fast they perform at production line speeds! They are so portable that you can inspect anywhere!

How these profitable methods apply to your business, is pointed out in "Seeing Isn't Always Believing," an interesting brochure you'll enjoy reading. **WRITE FOR IT!**

*MAGNAFLUX is a registered trade mark of Magnaflux Corporation.



MAGNAFLUX



MAGNAFLUX CORPORATION
7302 W. Lawrence Avenue, Chicago 31, Illinois

New York 36 • Pittsburgh 36 • Cleveland 15
Detroit 11 • Dallas 9 • Los Angeles 58

Welding Briefs

A structural steel fabrication shop was set up.

sq ft. It is steam heated, well ventilated, and kept under strict cleanliness control to avoid dust and moisture getting into the tubing, fittings, or instruments.

Felt, 1 to 1 1/4 in. thick, is used to support the instrumentation tubing lines. A power driven rotary cutter is used to cut sheets of felt into small sections. Then, a pneumatic powered punch with a hole spacing jig is used to punch the holes in the felt. Another device, a simple hand operated shear, is used to slit the felt for the insertion of instrumentation tubing.

Structural Steel Shop

A structural steel fabrication shop occupying about 20,000 sq ft of floor space was set up and operated to handle the large volume of fabrication work involved at the project site. The shop is equipped primarily to cut and weld structural shapes. Machine shop service is provided, as well as special services such as cable splicing, blacksmith shop, etc.

This shop is very effective in fabricating tons of various structural steel items on the job as needed, also in fabricating special parts to meet the requirements of construction operations throughout the project.

The operation of this shop on the job helped F. H. McGraw & Co. meet the tight construction schedule by providing a convenient, economical, and speedy structural steel fabrication service.

Electrical Maintenance

A shop containing about 6000 sq ft of floor space and a crew of diversified maintenance men is required to maintain the electrical equipment and keep it in repair. As a service call may be to repair a balky light switch or to do some trouble shooting on a 400 hp motor, a wide variety of maintenance supplies is needed.

More than 8000 were handled in 1952. There are around 200 time recording clocks which must be constantly checked and kept in

Turn Page

Hyde Park



Red Circle Rolls for all Purposes

Hyde Park Red Circle Rolls are outstanding in quality and in performance and are easily identified by the Red Circle.



for
finer finish
long life
greater tonnage
Specify Red Circle

Chilled Rolls
Alloy Iron Rolls
Moly Rolls
Nickel Chilled Rolls
Grain Rolls
Cold Rolls
Sand Rolls

Hyde Park

FOUNDRY & MACHINE CO.
Hyde Park, Westmoreland County, Pa.

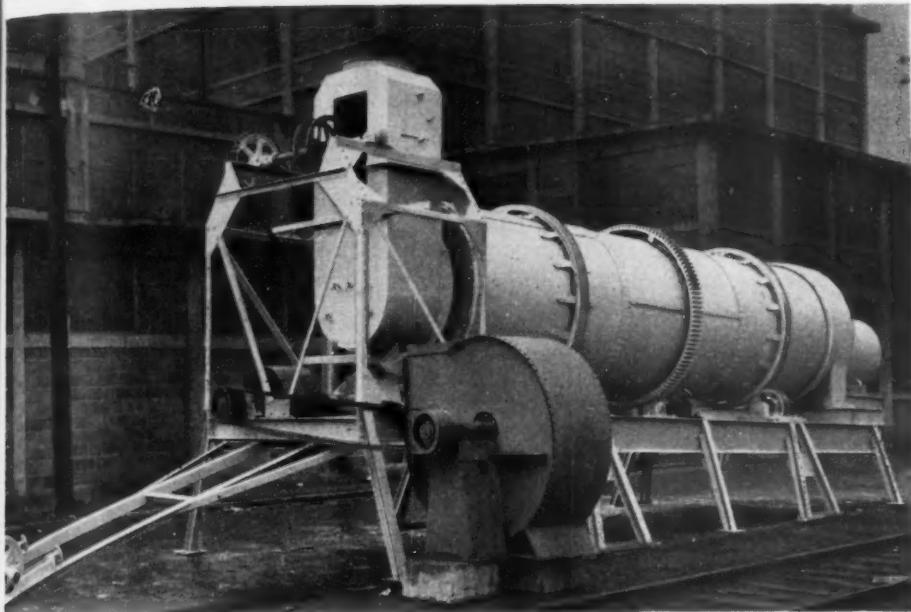
ROLLS

ROLLING MILL MACHINERY
GREY IRON CASTINGS

THE IRON AGE

what's your problem?

Here are **2 solutions** we've provided for others . . .
maybe we can help **you!**



● ROTARY DRYERS

designed and built for many industries: roofing products, foundries, fertilizer, chemical, sand and stone, etc.

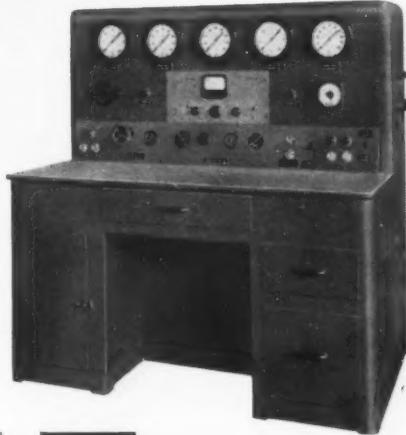
WARREN VHS SPINTEST MACHINE ●

For high speed spintesting of jet engine parts, guided missile components, etc., this remote control operating stand is used in conjunction with a vacuum service unit and a spin pit and turbine unit. Three models are available, with speed ranges 0-100,000 rpm . . . and more!

Other Instrument and Engine Accessory Test Stands of standard and special design are built for special purposes.

Our staff includes engineering and design personnel to assist in your problems. Inquiries for job shop or complete machinery are solicited.

From simple "one-of-a-kind" weldments to complex engineered units of special machines, phone, wire or write
Department 404



over **50** years
of service to industry



DESIGNING
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MANUFACTURING

WARREN BROTHERS
MANUFACTURING DIVISION

WARREN BROTHERS ROADS COMPANY

32 POTTER STREET • CAMBRIDGE 42 • MASSACHUSETTS

Welding Briefs

Radiography Kits



Complete
for
less than \$800⁰⁰!

Now available from one source . . . a complete, recommended package for industrial radiography. This new Raychronix package consists of an encapsulated source of strength to meet your needs, a cast iron shipping and storage container, electro-magnetic remote handling tool, Raychronix "Cutie Pie" radiation survey meter, carrying case, pocket dosimeters and dosimeter charger.

Two series — *Deluxe* and *Economy* — plus many options to supply the radiography kit most suitable for your operations.



Radioactive Products, Inc.
443 West Congress
Detroit 26, Mich.

Please send radiography kit details.

Name _____

Title or Dept. _____

Co. _____

Address _____

City _____ State _____

order, as well as an extensive traffic light system and the two-way radio systems of the patrol and fire forces which require prompt service. The repair of welding equipment, of which there are more than 1400 units on the job, and motors forms the bulk of the work.

Use of an organized electrical maintenance crew and shop proved to be most effective in controlling electrical maintenance activities and in rendering quick and efficient service.

Motorized Equipment Used

Equipment maintenance and repair is an around-the-clock-job, and the 1952 peak of operations required 75 mechanics in the field.

The shops — heavy equipment, light equipment, motor, tractor tread, tire, welding, magneto, grease, body, paint, and wash — are equipped to repair, maintain, dismantle and rebuild practically any piece of equipment on the job. A wide variety of spare parts and everything from small bearings to the giant maintenance tools will be found in the shop. In addition to automobiles and trucks of various kinds, items such as mobile cranes, tractors, arc welders, and countless other smaller, but equally important, items of equipment on wheels have to be maintained.

All cars and trucks are checked once a month in the "Safety Lane" and all heavy machinery is oiled and greased every three days. It is believed that this constant policing is one of the factors contributing to the enviable safety record of the F. H. McGraw & Co. organization.



Coupon preparation . . .

ELECTRODES, HOLDERS,
FORGINGS, CASTINGS,
ALLOY ROD & BAR STOCK
... For Better Resistance Welding.



means...

WEIGER-WEED SHIPS THE SAME DAY!

Service is what you can count on from Weiger-Weed. Many of the electrodes and holders listed in WW Catalog 14.650-4 are carried in stock. And, by means of a streamlined order-handling system, shipment is made from this stock on the same day the order is received. If there is not sufficient quantity on hand, part of your order is shipped immediately, the remainder later.

Along with this new, fast SSD service, you can continue to count on WW top quality in resistance welding materials.

WRITE, WIRE OR PHONE YOUR ORDER TODAY

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WEIGER-WEED & CO.
Division of Fansteel Metallurgical
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Carbides:

Drill bit life is improved with brazed carbide inserts.

Life of seismograph drill bits for drilling through certain earth formations has been greatly improved by brazing carbide inserts to the drill shank.

A technique developed at Bill White's Bit Co., Houston, Tex., successfully brazed carbide tips to moly-manganese cast drill shanks.

Inserts Stay In Place

A brazing alloy that had good capillary action, an affinity for both steel and carbide and high melting point to withstand heat treatment after brazing, was required for the job.

By this technique and the use of All-State No. 11 brazing rod and flux the carbide inserts stay in place during heat treatment



Grind surface clean . . .



Position carbide . . .

Turn Page

Morton Offerings for JET ENGINE PROGRAMS

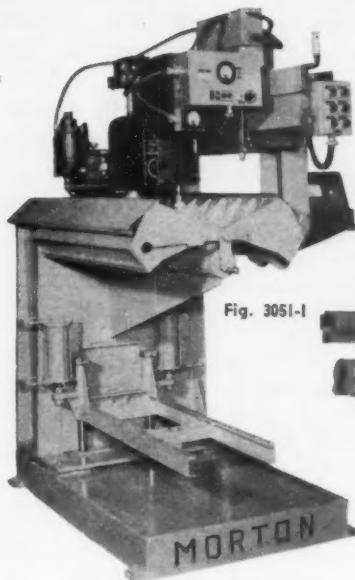


Fig. 3051-I

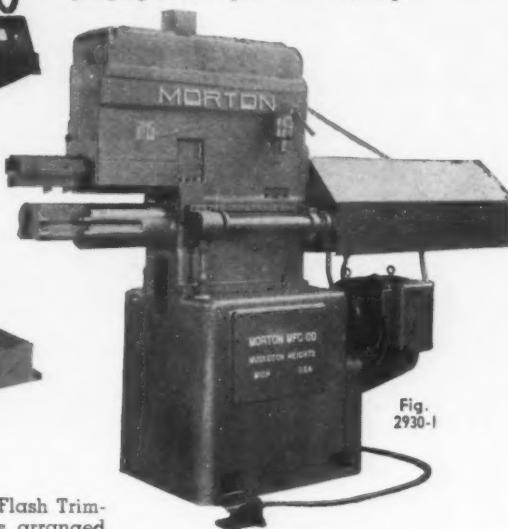


Fig. 2930-I

Fig. 2930, Bulletin No. 35-I

Morton 16" Stroke Heavy Duty Flash Trimmer Hydraulically Driven. It is arranged for flash and circular work having 9" minimum lower horn. It has 2" of operating distance between the dies and capacity for removal of flash of various alloys up to $\frac{1}{4}$ " thick.

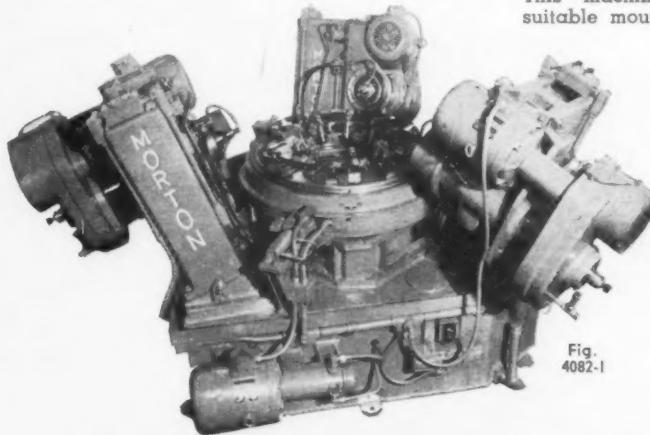


Fig. 4082-I

Fig. 4082, Bulletin No. 47-I

Special Three Head Index Milling Machine for milling the pads and bosses on combustion chamber of jet engines.

This machine consists of a suitable mounting base with a rotary indexing table onto which is applied three Special Angular Base Unit Milling Heads. The entire machine is hydraulically operated and is actuated electrically to accomplish full automatic cycle. Each milling head has independent motor and control drive for milling 20 pads.

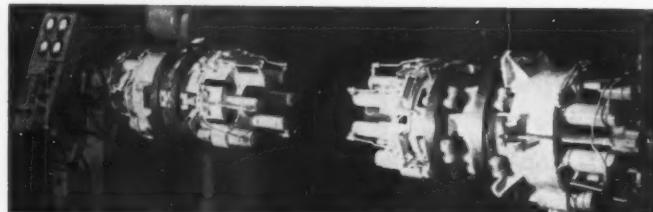


Fig. 3094-I

Morton Four Section Expanding Mandrel shown is designed to handle five separate shells and flanges and weld them into one component. Each section is under separate hydraulic control and expands a continuous back-up bar under each weld joint with approximately 10,000 lb. force available.

MORTON MANUFACTURING COMPANY

Muskegon Heights, Michigan

Welding Briefs

and give long life in severe drilling operations.

In the tipping procedure the drill shank is first ground clean where the tips are to be brazed. The shank is then screwed to a revolving fixture so that all flange areas are accessible for brazing.

Each insert is individually immersed in the brazing flux and placed on the bit flange with tweezers while the flange is heated from the bottom.

After the insert is in place it is bonded to the inside of the flange with a globule of No. 11 brazing alloy. This is then flowed through by heating the top of the insert and the bottom of the flange.

While the alloy is still plastic the inserts are adjusted by manipulating with a steel rod. The insert is then touched up to close any voids and the insert is filled and backed up with fuming bronze.



Globule holds insert . . .

Mid-States

Simplified Welding

Cuts Production Costs!

- AUTOMATIC ARC STARTING
- INSTANT AMPERAGE CHANGES
- WELDS FERROUS AND NON-FERROUS METALS
- UNVARYING OUTPUT—NO "CREEPING"
- NO PRESSURE TO CAUSE PINHOLES
- NO MOVING PARTS TO WEAR OUT
- 100% PENETRATION—SMOOTH BEADS

You Can Do a Better, Faster, Easier Welding Job with these **HEAVY DUTY** **Mid-States** **ARC WELDERS**

Operators do not need special skill to do a perfect welding job with Mid-States Heavy Duty Welders. You can weld heavy and light gauges, even 22 gauge, without danger of burning through. In addition, you can do brazing, soldering, hard-surfacing and heating. The plug-in type welder transformers are wound throughout with double glass covered magnet wire and stacked with high grade electrical sheet. The Mid-States Heavy Duty Welder is a complete outfit for every welding need. Write today for complete descriptive literature and the Simplified Welding handbook.



Mid-States WELDER MFG. CO.
6025 SOUTH ASHLAND AVENUE • CHICAGO 36, ILLINOIS



Heat backside . . .



Adjust insert . . .



Backup with bronze . . .

Turn to Page 214



We've rung a lot of door bells in 40 years

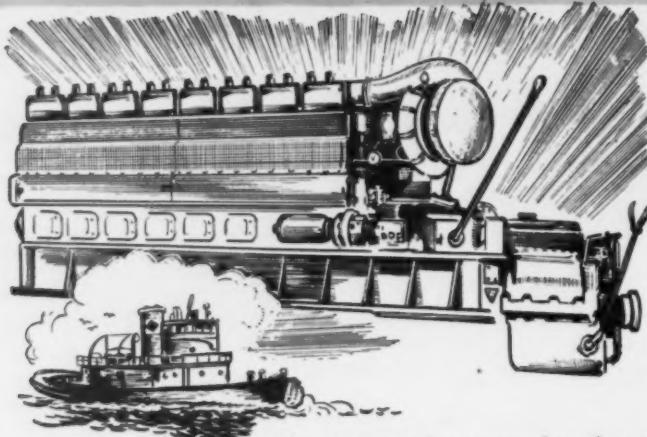
During Signode's 40-year history, its representatives have covered the nation — making calls, completing sales. They have pressed a lot of door bells and gained much experience that is of real value to you today in strapping methods and carloading.

Carefully sizing up the packaging or handling problem, our fieldmen can get the right answers by calling upon a file of tested and successful ideas, some originating on our first day of business. Other problems demand our package research talents or trial loading in actual freight cars on our private test track. So thorough are our studies and so complete are our recommendations that today Signode is a word that signifies the highest "Standard" of the industry.



SIGNODE STEEL STRAPPING COMPANY
2660 North Western Ave, Chicago, Illinois
In Canada: Canadian Steel Strapping Co., Ltd.
Montreal • Toronto

For **DEPENDABILITY**
IN
DIESEL ENGINES



The Correct Fastener for the Job

For over 38 years Erie has manufactured bolts and studs to the specifications of Diesel Engine builders. This specialized experience gained in working with leading Diesel designing engineers assures you of getting the exact materials and the precise tolerance in bolting desired for your Diesel. Send us your specifications for Diesel Connecting Rod Bolts, Cylinder Head Studs, and other special bolting.



ERIE BOLT and NUT CO.
ERIE • PENNSYLVANIA

STUDS • BOLTS • NUTS
ALLOYS • STAINLESS
CARBON • BRONZE

Representatives in Principal Cities.

—Welding Briefs—

Assembly:

Contact electrodes save time, end welding rejects.

Fewer rejects and increased production resulted in a change from high temperature to low temperature by a company making bombs for the Navy.

Warpage due to the high temperature of the welding method was the cause of the rejections. To increase production and cut costs, Hand-Omatic contact electrodes made by Eutectic Welding Alloys Corp., Flushing, N. Y., were tried. These rods were designed for welding light gage metal to heavy gage metal.

Operation Sequence

The most important welding operations were: (1) fitting the tail end to the bomb; (2) welding the tail fitting; (3) welding a lifting lug to the bomb; (4) welding the hanger lugs.

High strength efficient bonds were essential to the assembly. The lugs supported the entire weight of the bomb and rigid inspection was maintained because lives depended upon the holding power of the welds. The assembly was made of $\frac{1}{8}$ -in. cold rolled steel and the hangers of $\frac{5}{8}$ -in. forged steel.

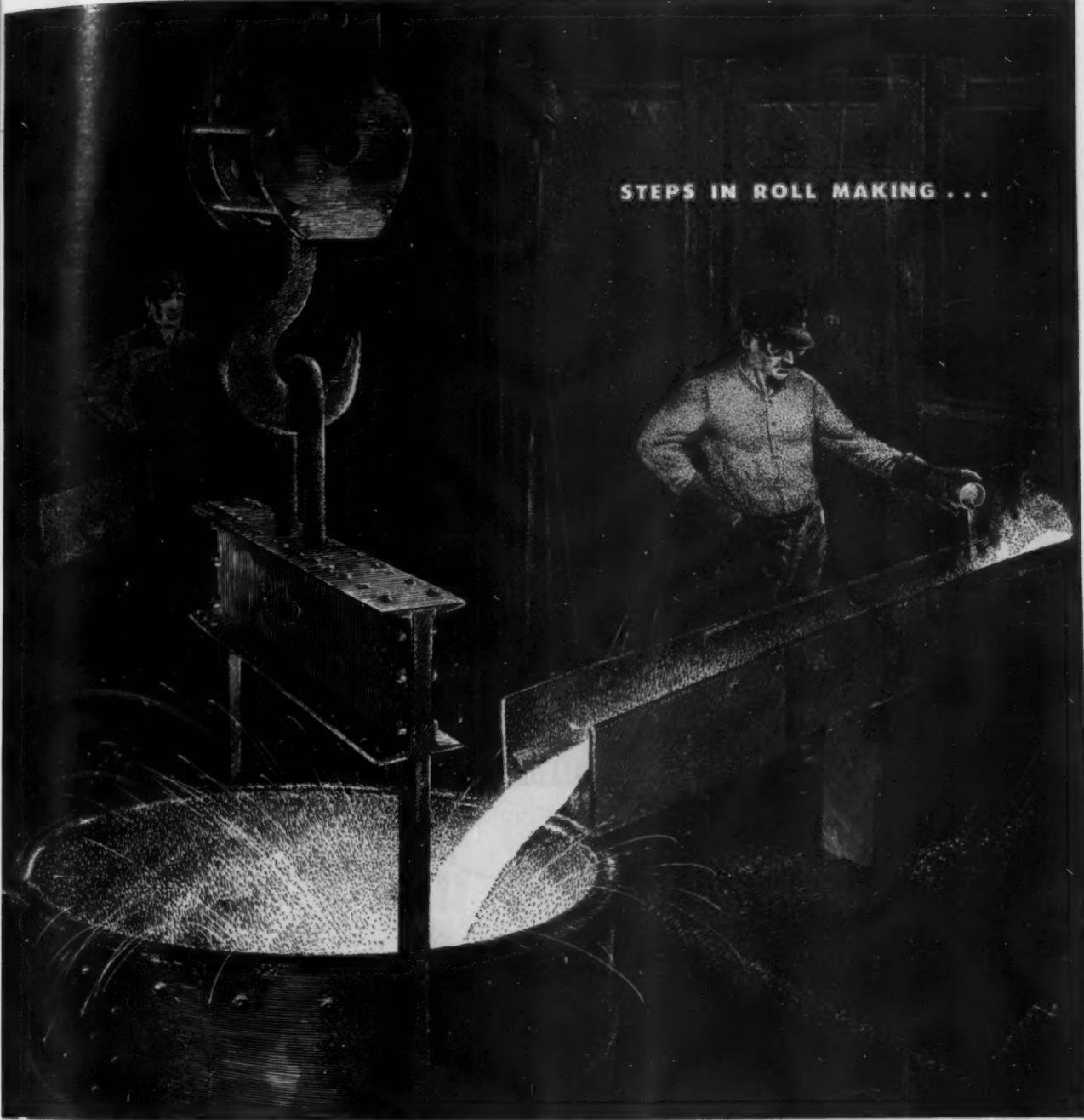
Less Operator Fatigue

Tensile strengths up to 72,000 psi were attained by this method of welding. A special coating on the electrode changes the characteristics of the arc from the bead-forming to a spray type of deposition, eliminating the gap. The edge of a joint, a vee, or seam is used as a guide.

The tip of the electrode is held against the edge and run rapidly along its length. Operator fatigue is reduced to a minimum and wrist and arm strain practically eliminated.

In this operation the weld area was thoroughly cleaned, the lifting lugs positioned and a direct current welding machine set at 135 amp with straight polarity for a $\frac{1}{8}$ -in. electrode. The arc was struck on a piece of scrap metal and carried to

Turn Page



STEPS IN ROLL MAKING . . .

Tapping a Heat

A GOOD MIXER

The skilled National Roll metallurgist mixes his batch according to formula, but he also knows through experience the extra ingredients to add to control roll strength, hardness or heat-resistance . . . and when the heat is tapped, it is a certainty that the batch is *right* to produce the roll specified. • Careful attention to a multitude of details in every step in roll making here at National results in sound, long wearing iron and alloy iron rolls that will live up to your service expectations.



National Rolls

THE NATIONAL ROLL & FOUNDRY CO.
AVONMORE, PENNSYLVANIA

SPECIALISTS IN IRON AND ALLOY IRON ROLLS AND CASTINGS

Welding Briefs

the weld area. It was held against the edge of the lug at a 15-20° angle to the work in the direction of travel.

The weld was completed rapidly and upon test was found to have more than the specified strength. No visible sign of warpage was discernible and the assembly was well within permitted tolerances.

Production Speeded

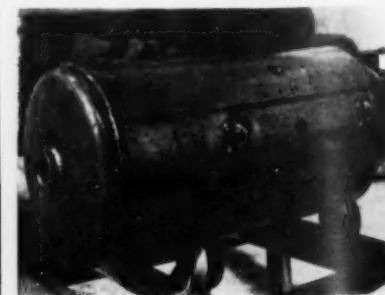
A turntable was used to rotate the tailhead of the bomb during welding. The speed of travel was adjusted for conventional electrodes and found to be too slow for the more rapid contact electrode. The turntable was set at three times normal speed to keep up with the increased speed of the operator.

A 5/32-in. Hand-Omatic electrode was used for the tailhead so the amperage was set at 150, straight polarity. The section had to be welded both inside and out. The turntable was set in motion and the electrode held against the edge to be welded. It was held in this position until the assembly had made one complete circle. The outside edge was done similarly. Both sides were completed in less time than it formerly took to complete one side.

Less Rod Required

The change to a contact electrode proved equally economical because it was possible to weld both sides of the tailhead plus one lug, with a single electrode.

The saving of time and labor on the total of 20,000 bombs being manufactured, was considerable. Production schedules were retimed as a result of the increased speed of operation and rejects virtually disappeared.

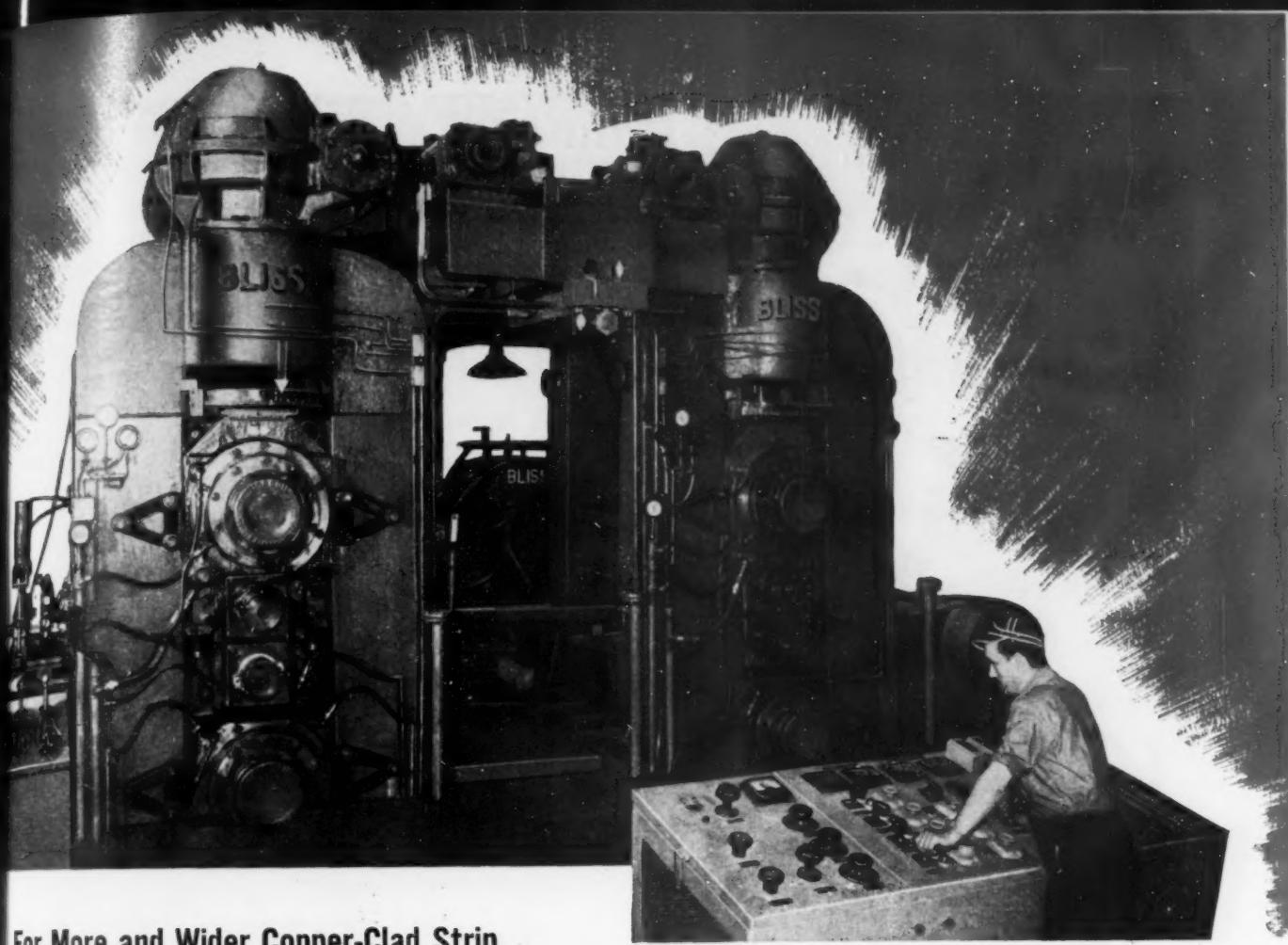


Bomb with lugs . . .
Turn Page

THE HALLDEN MACHINE COMPANY
THOMASTON, CONNECTICUT

Sales Representatives

The Wear Engineering Co., Inc., Warren, O. T. E. Dodds, Pittsburgh, Pa.
W. H. A. Robertson & Co., Ltd., Bedford, England



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Bliss also supplied all new terminal equipment, including tension reels, coil buggy, vertical belt wrapper, entry equipment and other accessories needed to facilitate fast handling.

Superior, like all leading mills in the country, often calls on Bliss rolling mill consultants for solution of mill construction and modernization problems. If you'd like to learn more about the many types of mills we have engineered all over the world, write for a copy of our revised Rolling Mill Brochure.

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Tough operating conditions mean nothing to this rugged, service-proven mobile crane. Operates with top speed, ease, and economy in any season or weather. It's designed to handle all types of jobs . . . dismantling, moving or erecting machinery . . . loading and unloading structural iron, pipe, bars, lumber and equipment of all types. Takes high cost and hard work out of material handling jobs for trouble-free, reliable operation. Reduces operator fatigue and increases production.

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Excavators. Cranes up to
20 tons capacity.

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Welding Briefs

Weld Seal:

Submerged arc used to close refrigerating units.

Hermetically sealed refrigeration condensing units for commercial air conditioning systems, two thirds the size of units now in use, are being successfully produced by General Electric Co. through the use of improved welding techniques.

Four sections of $\frac{1}{4}$ -in. deep-drawn steel plate house the compressor and condenser in a shell made air-tight by welding of the joints. Shape of the housing and the need for smooth welds applied at high speed made this job ideally suited for submerged melt welding. Two welding setups, each equipped with a Unionmelt DS head and necessary jigs, perform the four operations necessary to seal the unit.



Shell and inner shell . . .



Fixture clamps parts . . .

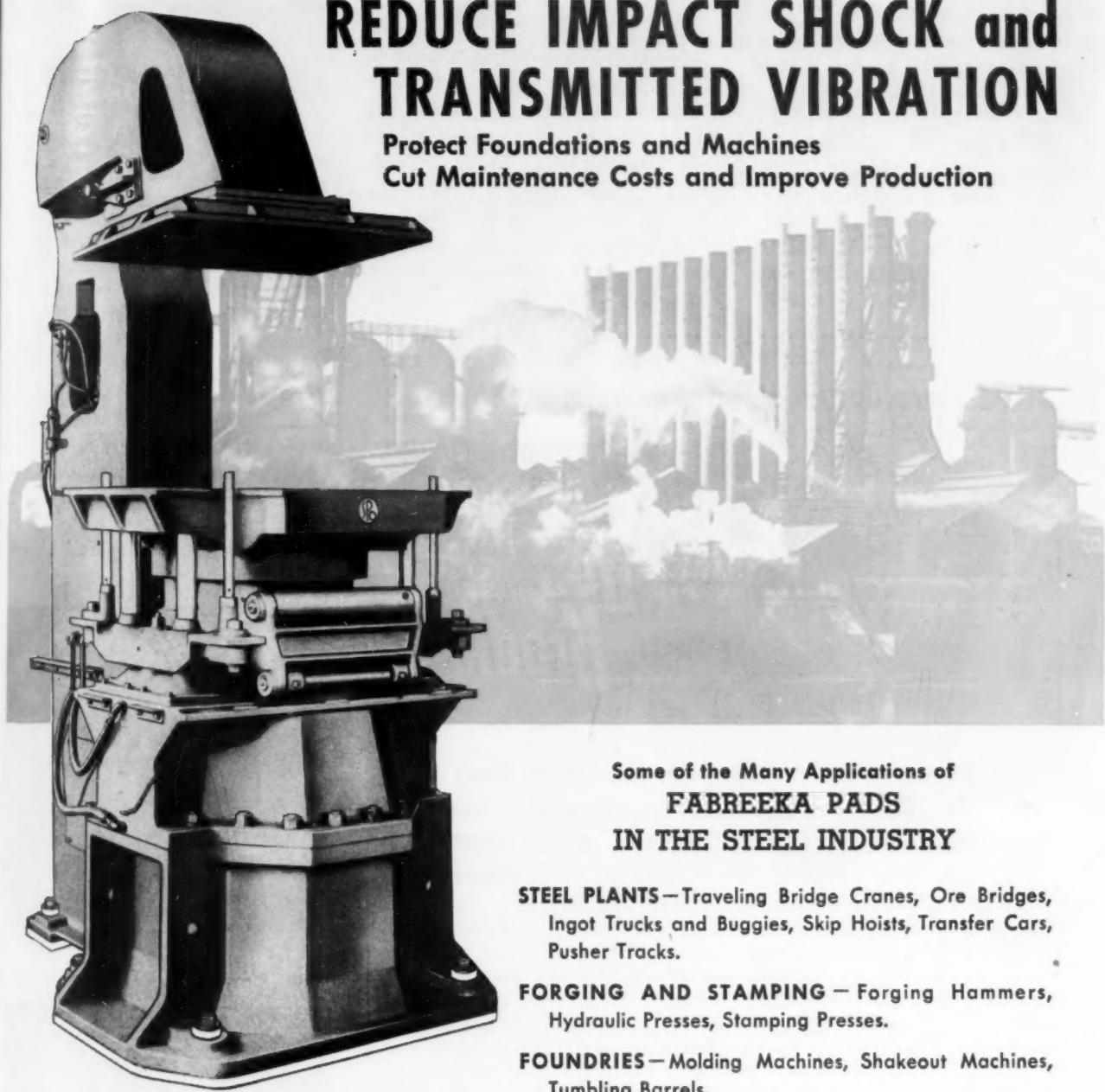
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THE IRON AGE

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Welding Briefs

Sections are placed in a jig on a rotating fixture.

Fabrication of the housing begins with a continuous 37½-in. fillet weld joining the smaller-diameter inner shell to the bottom shell. Two sections are placed in a jig on a rotating fixture set at a 45 deg. angle. A Unionmelt DS head, mounted in a fixed position, welds the joint at a speed of 12 in. per minute.

Coiled 3/32-in. Oxfeld No. 29 rod and Unionmelt grade 90 com-

position are used. This operation is performed at 360 amp, direct current, reverse polarity, using a suitable jig.

Groove Machined

Next, the shell top is welded to the unit just completed. A circular V-groove is machined into the top of the shell, to a depth of two thirds the thickness of the metal.

This groove assures a flat weld that penetrates through the top shell and into the inner shell to about one half its thickness. After

water coils are encased in the shell top, the parts are assembled in a fixture so that the shell top is positioned over and rests upon the smaller-diameter inner shell assembly, much like a canopy.

One-Pass Weld

The fixture table is tilted at 20° so the weld surface will be level and a one-pass weld is applied to the grooved circle. Resulting weld is level with the surface of the shell and requires no finishing. Controls are set at 365 amp, direct current reverse polarity, and welding time required for this operation is one minute.

Following this step, the same assembly is mounted horizontally in a lathe-like fixture which turns it beneath another DS welding head. A slide rail supports the welding head parallel to the work so that it can be positioned easily for making the two welds required on the outside shell.

Latest development for production shops...



Automatically feeds all types of coiled materials — wire or strip-to-punch presses, shears, slitters, forming rolls, etc. Supplies stock only as machine needs it! Motor operates intermittently by means of slack loop control. Adjustable Timer — Provides a shut-off delay after motor switch is tripped. A slack loop of predetermined length is then formed from which forming machine can draw. Adjustable width control — Reel space is quickly adjusted to accommodate varying roll sizes by rotating a crank. Steel guide plate is moved laterally by three lead screws, simultaneously driven by roller chain. Reversible motor — Operates in either direction for feeding or rewinding stock. Reversing switch is supplied as standard equipment. Easy loading — Slack loop actuating bar lifts up, exposing entire reel area. Coils are rolled up ramp, eliminating all lifting. 4 power driven rolls, linked by roller chain insure positive reel drive. Rolls are heat-treated for maximum life. Anti-friction pillow blocks — Power rolls and back-stop roll are mounted in cast iron pillow blocks, each equipped with roller type needle bearings for long life and trouble-free operation. Alemite fittings permit easy lubrication.

See your dealer or contact
Benchmaster Manufacturing
Company 1835 West Rosecrans
Avenue, Gardena, Calif.

The Benchmaster Koil Kradle is designed to fulfill a wide variety of feeding problems. It automatically supplies a slack loop of material feeding any machine from the slack loop rather than from the weight of the coil. Material fed over the actuating bar triggers a micro-switch as the slack loop tightens. The power rolls then rotate the coil, forming a new slack loop; correct loop size is uniformly maintained for any machine requirement, with no attention from the operator! Standard coil speed, continuous operation, 90 feet per minute.

THREE SIZES

Model	Load Capacity	Roll Width	Roll Diameter	Motor h.p. & phase*	Approx. Shipping Wt.
310	1200 lbs.	10"	36"	1/4 h.p. single phase	302 lbs.
313	1200 lbs.	13"	36"	110 V ac; ball bearing, capacitor type. (3 phase available)	310 lbs.
315	1200 lbs.	15"	36"		328 lbs.

*All motors reversible, reversing switch supplied as standard equipment.

benchmaster

World's largest
manufacturer of small punch
presses and mills.



Weld joins shells . . .



Cap doubles as base . . .

Turn Page



This illustrates the extreme flexibility of Cleveland Tramrail. This rail system is so laid out that hand-operated hoist carriers can deliver materials from any press to any other press without intermediate handling.

Courtesy United States Register Co., Battle Creek, Mich.

**TRAMRAIL SERVES
EVERY PRESS**
at United States
Register Company

**75% REDUCTION IN TIME FOR DIE
CHANGES - NO HANDLING ACCIDENTS
SINCE INSTALLED IN 1938 . . .**

An inexpensive, easily-installed, hand-propelled Cleveland Tramrail system interconnects all presses with each other and also connects each with the die storage and machine shop. All but 18 small presses are served this way.

Hand and motor driven hoists are used in making die changes and servicing the presses with raw stock. Dies up to one ton are handled without difficulty and with 75% reduction in time over hoists formerly used.

No accidents in the handling of dies and materials have occurred since this system was installed in 1938.

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PITTSBURGH CRUSHED STEEL CO., Pittsburgh, Pa.
STEEL SHOT AND GRIT CO., Boston, Mass.



Welding Briefs

Coil Sealed In

The lap joint between the top and the bottom shell is fillet welded in one pass, sealing in the water coil assembly. This 50-in. circumferential weld is made in 56 seconds at



Weld shell and bottom . . .

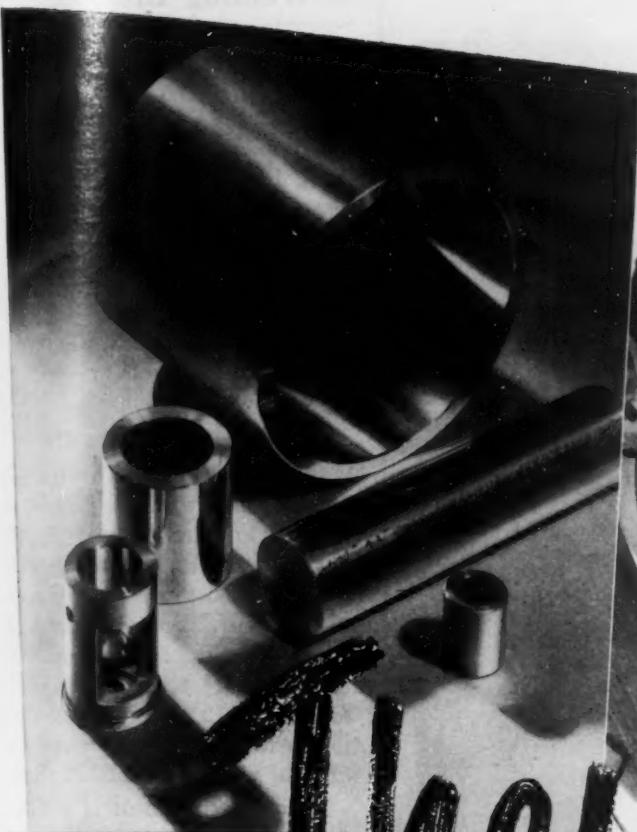


Welds seal units . . .



Check for leaks . . .

Turn Page



They

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A phone call to your nearest local Bunting Distributor will bring you immediately a few or many completely machined and finished Bunting Bronze Standard Stock Bearings for production or maintenance of machine tools and plant machinery of all kinds. No further finishing is required in most cases—wide range of sizes meets practically every need. They are always in stock, awaiting your order.

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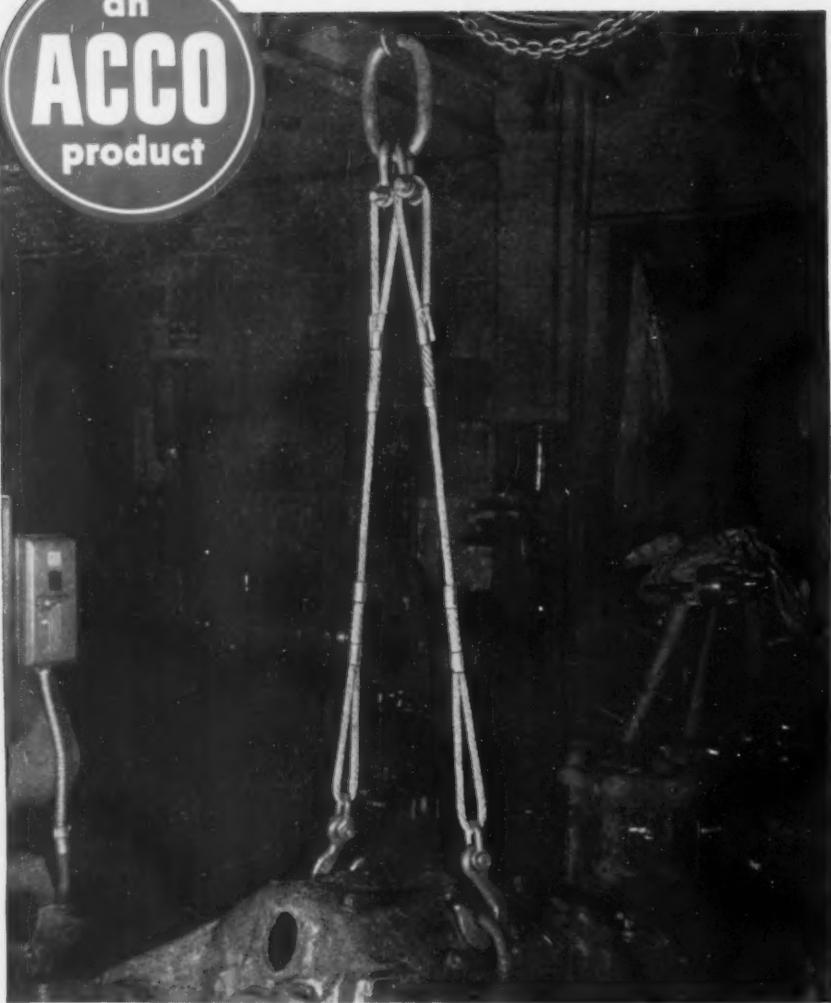
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DUALOC
Slings**

Welding Briefs

Condenser unit is subjected to rigid inspection . . .

430 amp. Rod is Oxweld No. 29,
1/8-in. diam is used.

Next the assembly is inverted and placed on a roller conveyor which takes it to the next station where the working parts of the compressor are inserted. The bottom cap, at the left, is made of the same material as the top and bottom shell.

Bottom Cap Goes On

The unit is replaced in the horizontal fixture with the bottom cap clamped in place for welding, thus making the unit completely air tight. The bottom cap, besides closing the unit, also serves as a base or stand for the compressor. Welding procedure for this lap joint is the same as in the preceding operation, except that two passes are made in a total time of 106 seconds.

The condenser unit is subjected to rigid inspection. High-pressure air is forced through hoses connected to outlet plugs on the unit which is completely immersed in a water tank.

Ease with which the condensing units pass this test is a testimonial to the quality of the welding performed at this plant. Skilled workmanship combined with precision welding equipment is producing a steady product flow.

Improved welding methods developed during the past few years, plus new designs which take advantage of superior materials, have been important factors in the rapid growth of "sealed-in" units.



Ready for shipping . . .

Tractor Wheels:

Modern welding helps build huge earthmoving equipment.

Powerful, rubber tired tractors are important, versatile machines in the heavy construction field. They are used extensively in building roads, airfields, huge dams and other large man made wonders.

One such type tractor built by the Caterpillar Tractor Co. uses disk wheels to withstand the severe service of this work.

Welded Rims

Wheel center assemblies of $\frac{3}{8}$ in. thick medium carbon steel are welded to rims to produce these wheels. A modern method of doing this job uses a portable Unionmelt welding machine built by Linde Air Products Co., division of Union Carbide and Carbon Corp., N. Y.

In process a rotating fixture turns the wheel assembly under the welding head. The weld is protected from contamination by a blanket of granular welding composition and top quality welds are produced from the high heat and deep penetration into the base.

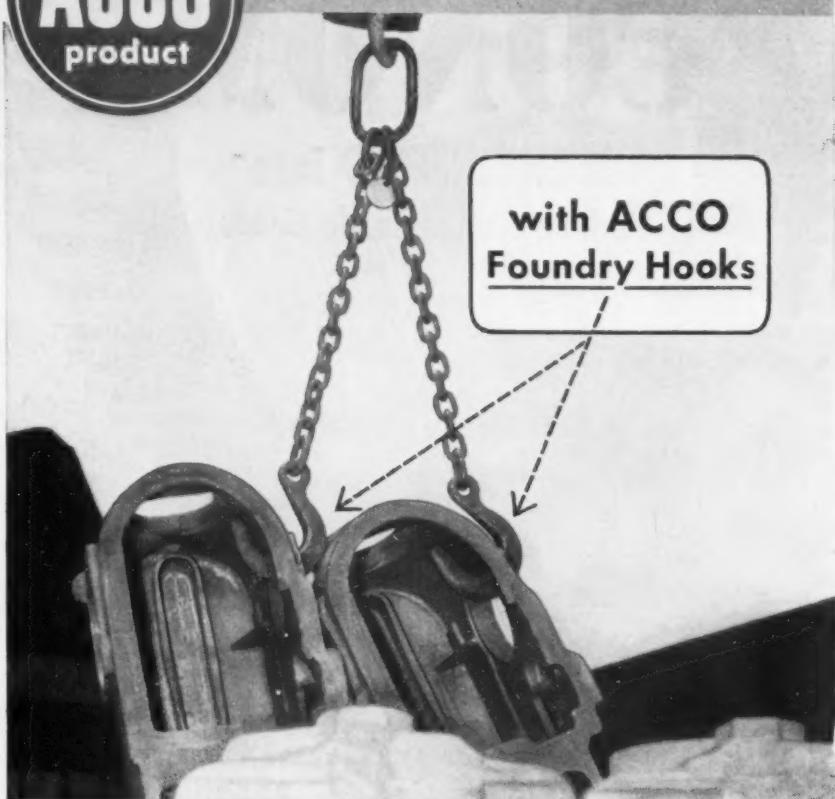


Welds are protected . . .

Turn Page



ENDWELDUR SLING CHAINS



How You Can Speed Up Handling of Castings

• Castings frequently are odd shaped and hard to hitch to with regular sling hooks. So AMERICAN developed the series 500 ACCO Foundry Hook with rounded point and wide mouth that can be hooked to a wide variety of lifts.

These hooks are drop forged of the same material as the chain. They are built into ACCO Registered Endweldur Sling Chains at the factory and the complete assembly is proof-tested from bearing to bearing.

ACCO Foundry Hooks are safer than home-made hooks. And they're cheaper because you save the cost of fabricating and assembling to the chain in your plant. The completed unit bears the well-known ACCO Registered identification ring—your assurance of highest sling chain quality.

See your AMERICAN CHAIN distributor or write our York, Pa., office for DH-130

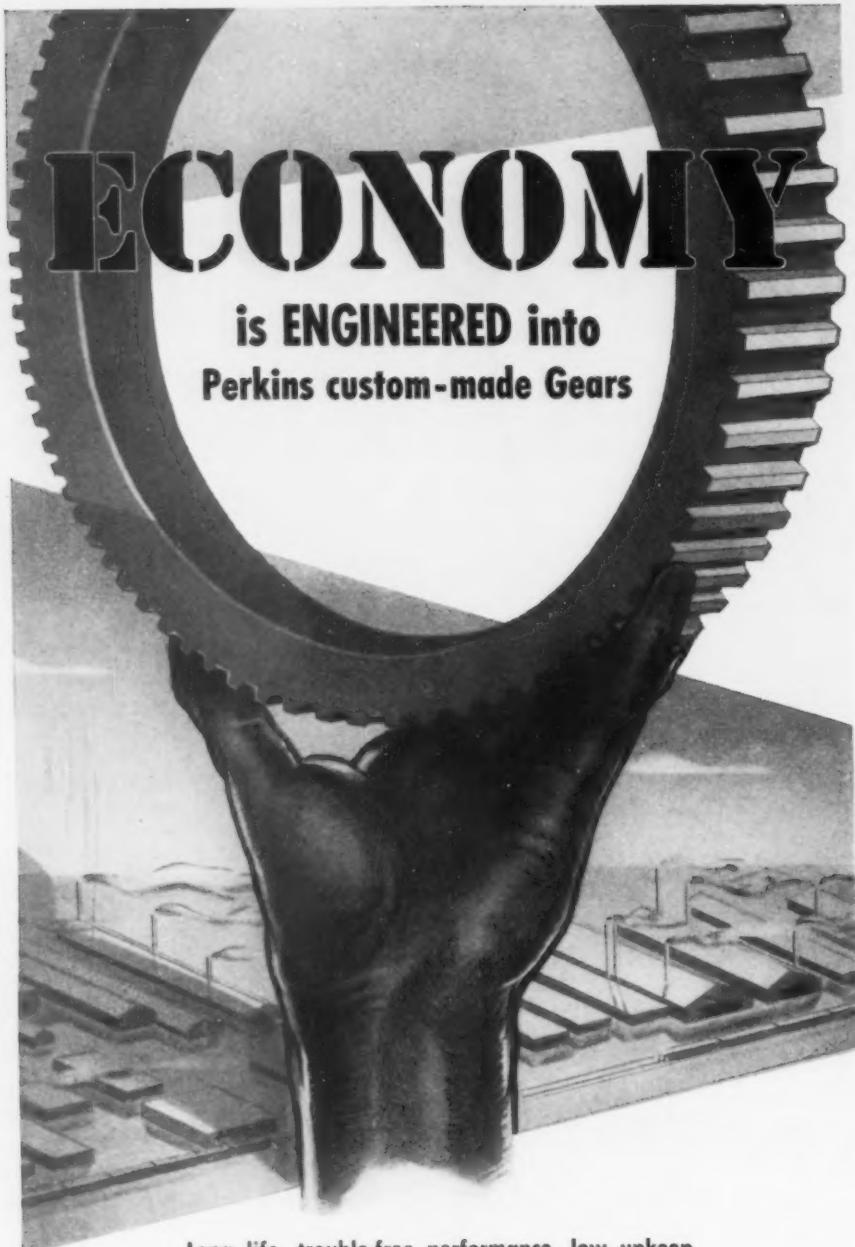
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Long life, trouble-free performance, low upkeep record—that is the true measure of gear cost. Using those factors as a means of comparison, PERKINS GEARS cannot be surpassed. As a result, you will find PERKINS PRECISION GEARS in the power transmission systems of the finest products made by industry throughout the United States.

As one of the country's leading gear engineering organizations—solidly backed by a tradition of New England craftsmanship, we are able to produce—to your specifications—any size gear, in any material and in any quantity. Ask us to quote on your requirements.

PERKINS MAKES: helical gears, bevel gears, sprockets, ratchets, worm gears, spiral gears, spur gears with shaved or ground teeth, ground thread worms.

NOTE 1: A new product is the Perkins Precision Spring Coiler. This coiler (patent applied for) turns out precision springs—any type, shape, size, from wire sizes .005 to .125.

2: Another new product—the Perkins "Bendit 15"—a patented metal forming machine bends and shapes sheets, rods, strips, tubing into innumerable complex as well as simple forms that would be difficult or impossible to make by other means. Eliminates need for expensive tools or specialized skills. Ht. 47", net wt. 200 lbs. Write today for descriptive catalogs, prices etc.

PERKINS Machine & Gear Co.
WEST SPRINGFIELD, MASSACHUSETTS

Welding Briefs

Cast Iron Rod:

New electrode developed to weld cast iron cold.

Many problems normally encountered in welding cast iron can be eliminated by use of a new electrode recently developed by Eutectic Welding Alloys Corp., Flushing, N. Y. Called Xylon, this electrode has a specially formulated coating. Certain additives in the electrode coating not only replace those elements lost through the arc, but give the deposited metal properties for maximum weldability and machinability.

Uses Low Amperage

Amperage requirements for the new electrode are low. For example, a 3/32-in. diam electrode operates in the range of 35 to 75 amp. No preheating of the base metal is necessary with this electrode, and it can be used for buildup work, repairing of breaks and cracks, and for general fabricating purposes.

Welding may be done in all positions and repairs may be made without dismantling an assembly to position it. No special preparations of the workpiece are necessary in using the new rod.

Easy to Apply

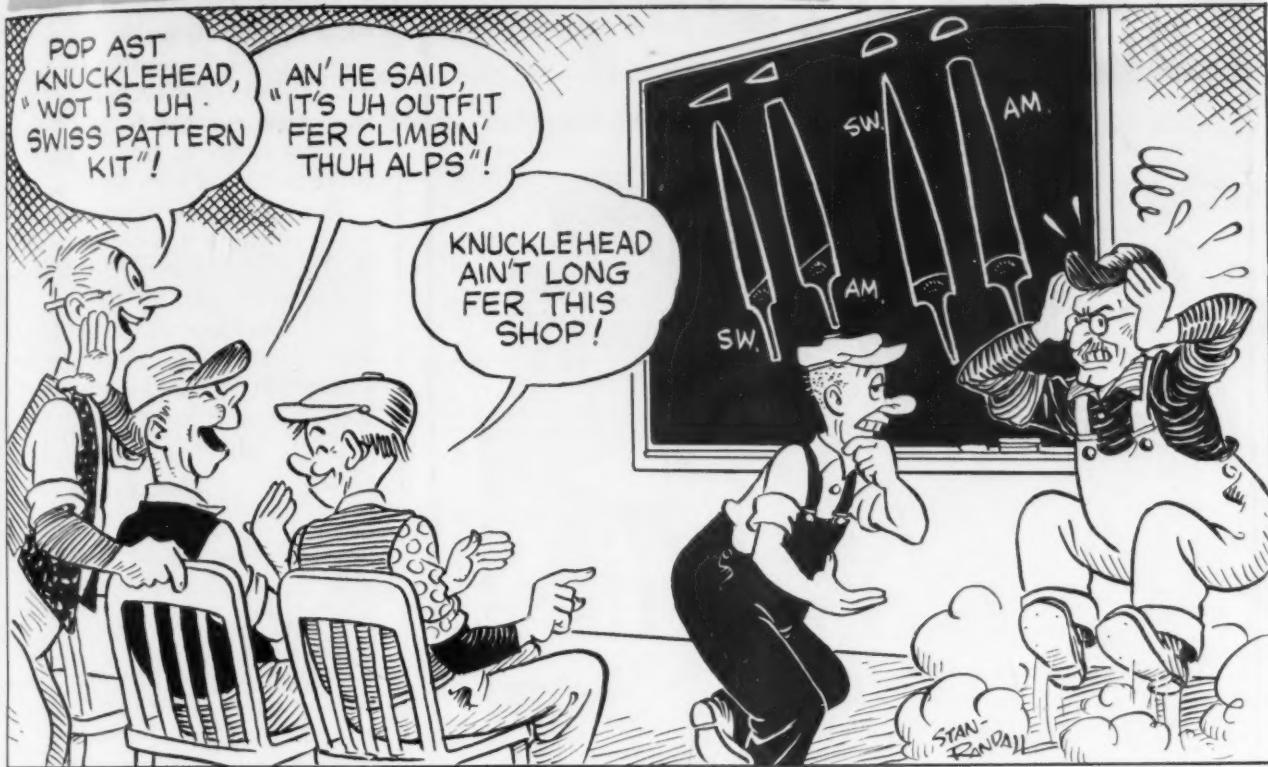
No special skill is required to weld cast iron since arc length is not critical. If the recommended procedure is followed, deposits will have high tensile strength.



More uniform weld...
Turn Page



POP'S School of Filing



Precision work is the main purpose of Swiss Pattern files, and their uses have been expanding year after year. Tool, die and model finishing, instrument assembling, slot rounding and bur removals from drilling and machining operations are among their widest fields.

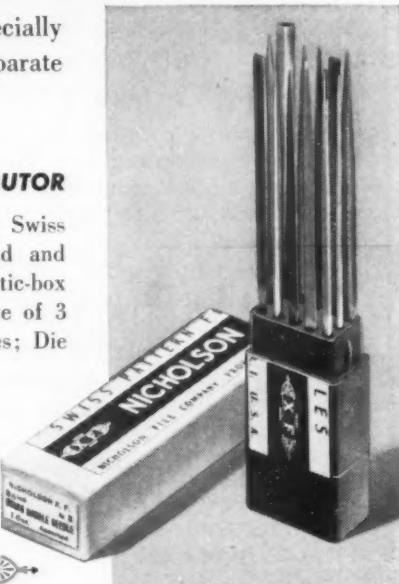
Nicholson is considered today's foremost manufacturer of such files. Shapes, cuts and sizes are almost legion. Measurements are more exacting than in American patterns. Points are smaller; tapers are longer.

Because of their extra fine quality and workmanship, Nicholson Swiss Patterns are appropriately trademarked X.F.

They are the handicraft of specially trained file cutters working in a separate section of the Nicholson factory.

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for any of these NICHOLSON X.F. Swiss Pattern file types or groups: Round and Square Handle Needle files (in plastic-box kits of 12 assorted shapes and choice of 3 lengths and 4 cuts); Die Sinkers files; Die Sinkers and Silversmiths Rifflers; Filing Machine files. Individual Crochet, Barrette, Slitting, Crossing, Pippin, Joint, Screw Head, Warding, Equaling, Corrugating, Pillar Testing, Round, Flat, Square, Three Square, Knife—and many others.



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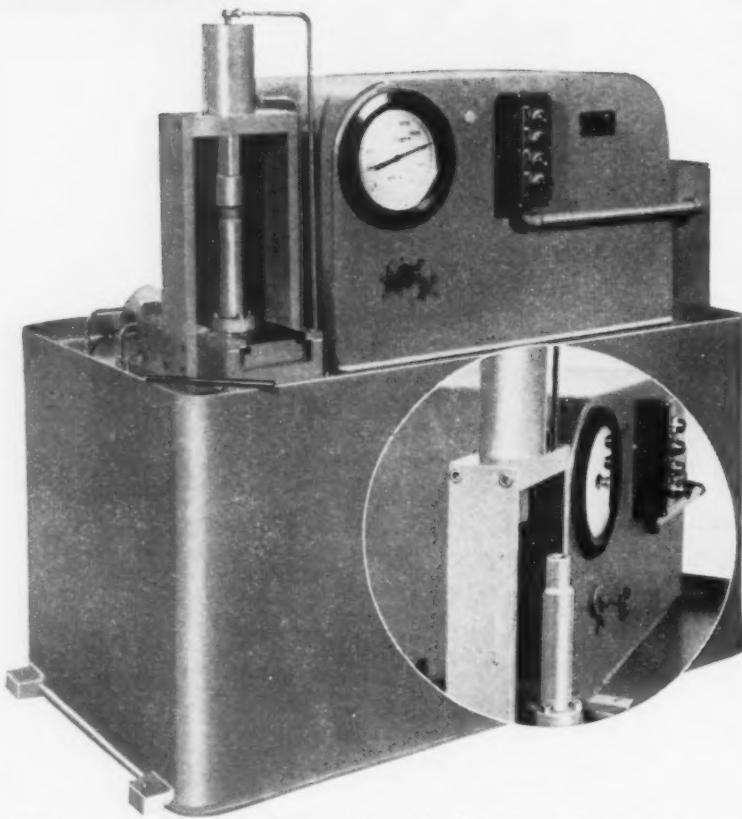


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Hydrostatic testing of tubular, cylindrical or hollow shapes has been performed with Steel City equipment for many years. Leading manufacturers, plus Army and Navy Ordnance, have used these units for internal pressure tests on a mass production basis.

Steel City's service includes designing the machine to satisfy testing and production requirements, manufacturing the unit and installing in the customer's plant. Our varied experience includes a large variety of ammunition components, all tested to rigid Government standards.

Here is a typical hydrostatic testing machine for testing short lengths of tubing. Other typical applications are described and illustrated in a descriptive bulletin. If you have a hydrostatic testing problem, write for your copy or the name of our nearest Sales Representative.

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Welding Briefs

Field Welds:

Automatic machinery developed for welding vertical plate.

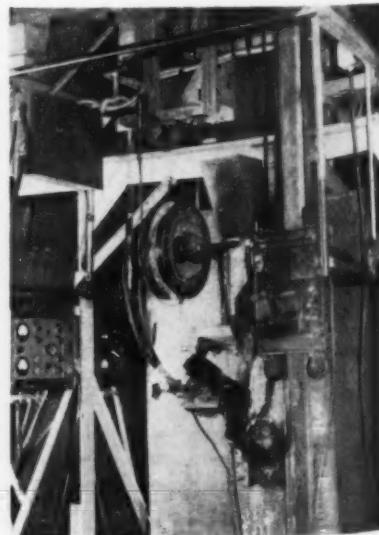
Despite generally wide application of automatic welding equipment in tank fabricating shops during the past decade, development of automatic machinery for welding vertical seams in vertical plates of large tanks has been slow.

For shop-built equipment, automatic submerged metal-arc welding during recent years has become standard among all leading steel plate fabricators, but automatic field welding on larger storage tanks—employing the submerged metal-arc process—has continued to be a difficult problem to solve.

What Went Before

Research by the Graver Tank & Mfg. Co., East Chicago, Ind., some time ago succeeded in developing field devices for automatically welding horizontal seams in vertical plates. Such apparatus has been utilized on field-erected projects for some time. But a method of welding vertical seams in vertical plates was still needed.

Now, by means of these two devices, Graver is able to weld automatically both the horizontal and vertical seams of the steel shell plates in field-erected tanks. Development of the welders overcomes many obstacles to the efficient automatic welding of field-erected tankage.



Makes vertical welds...

Welding Notebook

Tough welding problems, successfully conquered, offer a guide for problem jobs in your shop. . . . These methods have helped cut production costs, extend equipment life.



JOB

Steam shovel bucket.

PROBLEM

To increase capacity of shovel bucket from one and a half to two yards and extend bucket life.

SOLUTION

Build up open end of bucket with flame cut steel plate and mild steel welding rod. Hardface with Coast Metals #112, the leading edge of extension and all wear surfaces of bucket lip and points of teeth.

RESULTS

Except for temporary downtime for tooth replacement, bucket has been in continuous operation from early 1953. Continuous service, increased material handled have paid for cost of enlarging and hardfacing.

Data courtesy Coast Metals Inc., Little Ferry, N. J.

JOB

Braze center core of cobalt-chromium-tungsten alloy casting.

PROBLEM

Find a brazing alloy stronger than silver solder which would flow like silver solder and have a high affinity for both mild steel and the special casting. Costs had to be less than silver and the flux easy to apply.

SOLUTION

Apply All-State No. 11 nickel-silver brazing rod with a torch.

RESULT

Brazing was accomplished at 1750°F. This rod has a shear strength of 160,000 psi.

Data courtesy All-State Welding Alloys Co., Inc., White Plains, N. Y.



JOB

Joining stainless steel flange to a brass tube for a television wave guide.

PROBLEM

With induction and torch brazing rejects were running as high as 70 pct because of distortion.

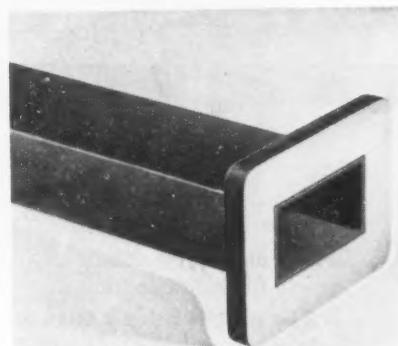
SOLUTION

Silver brazing in an Ajax Electric Salt Bath Furnace.

RESULTS

Rejects cut to zero.

Data courtesy Ajax Electric Company Inc., Philadelphia



JOB

Sealing rim for pontoon.

PROBLEM

Nonuniform buildup and excessive distortion prevented a tight water seal.

SOLUTION

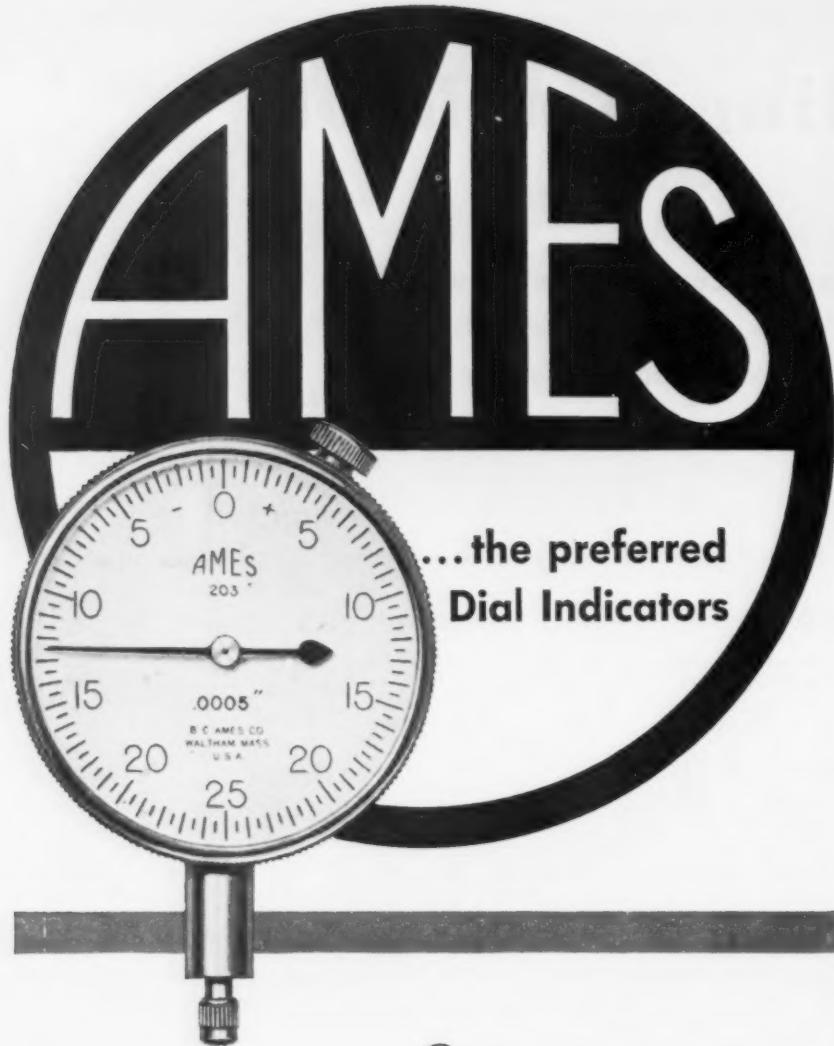
Lay a 3/16 in. mild steel welding electrode around the top of the pontoon and lay a weld bead over it. Electrode is held down by a 1/4 in. roller to insure good fusion and to guide the wire.

RESULT

Bead is very uniform in height and distortion is at a minimum.

Data courtesy Lincoln Electric Co., Cleveland

Turn Page



One of America's largest and most famous mass-producers recently chose Ames as preferred source of supply for indicator gauges.

The reasons behind this decision are the very reasons why you should standardize on Ames dial indicators and dial gauges:—the Ames "Hundred Series" indicators available in four sizes, fit every measuring requirement; they are accurate, sensitive, low in friction, yet are rugged and tough—give more on-the-job time. All Ames products embody latest design and highest-quality materials; they are manufactured by methods and machines that are exclusive with B. C. Ames Co.



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—Welding Notebook—



JOB

To extend the service life of ingot tong bits.

PROBLEM

Combination of heat and pressure of forged bits made necessary replacement after only a few lifts.

SOLUTION

Hardface the point of the bits with Coast Metals No. 18 and grind smooth.

RESULTS

As many as 90 lifts from one pair of hardfaced tong bits were obtained.

Data courtesy Coast Metals, Inc., Little Ferry, N. J.



JOB

Fabrication of aluminum bronze rubbers for minesweepers.

PROBLEM

Elimination of post-weld cleaning of slag and residues from flux.

SOLUTION

Displacement of the "stick" electrode process by the inert-gas shielded metal arc welding process.

RESULTS

Post-weld cleaning was eliminated because of the inert-gas shield used. Labor costs were further reduced by welding speeds of 20 ipm.

Data courtesy Air Reduction Sales Company, New York City, N. Y.

Turn Page

THE *New Look* IN PICKLING LINE PINCH ROLLS



Youngstown Continuous Strip
Pickling Line Complete with
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REGISTERED TRADE-MARK

the rolls with uniform hardness all through, which
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neers quote on Paralloy pinch rolls—modernizing your present
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Youngstown, Ohio



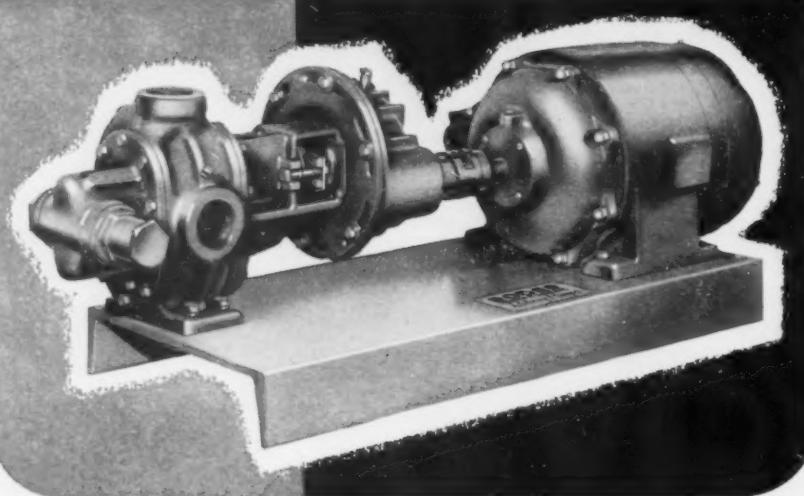
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PUMP



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Compact . . . requires minimum of installation space.



Steel Bed Plate provides rigid foundation for pump and motor.



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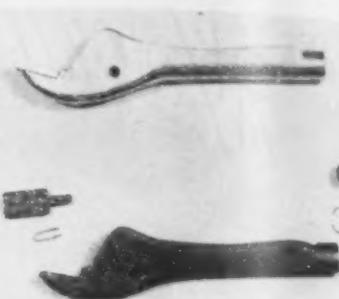
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Rockford, Illinois



Welding Notebook



JOB

Braze steel jaw insert in wrench jaw.

PROBLEM

To improve quality of wrench, cut production costs, and assure joints passing test of 40,000 psi.

SOLUTION

Brass-Brazing (and carburizing) in an Ajax Electric salt bath furnace.

RESULTS

One immersion did two jobs—brazing and carburizing; rejects reduced 50 pct; costs slashed 51 pct; higher quality wrenches, and 40,000 psi acceptance tests passed satisfactorily.

Data courtesy Ajax Electric Co., Inc., Philadelphia



JOB

Spring support.

PROBLEM

To securely fasten spring support to metal post without marring the inside surface.

SOLUTION

Jig locate KSM welding studs on each post and weld with welding gun. Spring supports are then fastened with nuts.

RESULTS

Drilling, supporting, peening and hand filing were eliminated with estimated savings amounting to \$10,000 per year.

Data courtesy KSM Products, Inc., Merchantville, N. J.

Turn Page

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when this Ferracute Inclinable swings into action

A manufacturer of low-cost, one-time-use aluminum foil pie plates finds this 32-ton FERRACUTE inclinable press perfect for high-speed, trouble-free production. Equipped with 3½" diameter feed rolls 12" wide, permitting feed 0" to 18", and pneumatic die cushion with 1.4 tons ring holding pressure, the press holds consistent, day in, day out production "easy as pie." This operation is typical of thousands of applications where FERRACUTE open-back inclinables fit in efficiently and profitably.

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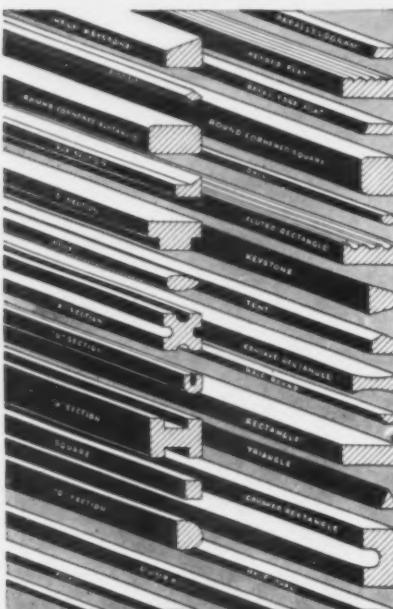
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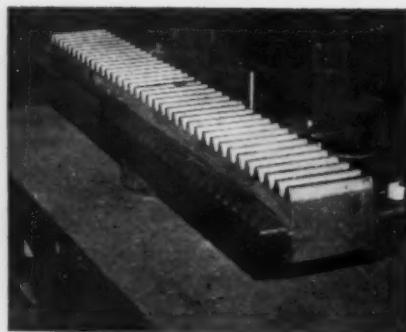
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635 E. Polk Street, Milwaukee 2, Wisconsin

Welding Notebook



JOB

To overlay worn slides of a steel mill manipulator rack.

PROBLEM

Slides on manipulator racks wear rapidly in severe service. Required economical manner to reclaim with wear-resisting alloy.

SOLUTION

Metal-arc method replaced with automatic submerged-arc process and hard, wear-resisting Ampco-Trode 160 weld deposit.

RESULTS

New method more economical and service life increased greatly.

Data courtesy Ampco Metal Inc., Milwaukee



JOB

Securing inner bearings for stator blades on compressor stators used in fabrication of a giant wind tunnel.

PROBLEM

Excessive tooling, machining and materials handling costs involved if conventional drilling, reaming and tapping methods were employed.

SOLUTION

Studs were end-welded directly to stator rings with portable Nelson stud welding gun.

RESULTS

Savings effected by stud welding on this project approached \$100,000, approximately 50 pct of which resulted from the saving in tooling cost.

Data courtesy Nelson Stud Welding Div., Morton-Gregory Corp., Lorain, Ohio



JOB

Replace broken teeth on a cast iron gear.

PROBLEM

Replacement part could not be purchased for several months, idling an essential piece of production equipment. Welding of cast iron is often difficult.

SOLUTION

Teeth were welded and built up with Nickel-Arc, a nickel-copper electrode specifically designed for welding cast iron.

RESULTS

Broken gear was back in operation within 12 hours of breakdown at a fraction of the cost of gear replacement.

Data courtesy Alloy Rods Co., York, Pa.



JOB

Asphalt mixer screw.

PROBLEM

Excessive wear of the mixing screw caused shutdowns every few weeks for replacement.

SOLUTION

Hardface all surfaces of the screw with Coast Metals No. 112.

RESULTS

Continuous operation for a full season without shutdown for screw replacement has boosted production and saved many times the cost of hardfacing.

Data courtesy Coast Metals, Inc., Little Ferry, N. J.

Turn to Page 242



JOB

Friction Twist Guides for steel bar mill.

PROBLEM

To overcome excessive wear caused by the hot bar stock feeding through the friction twist guides.

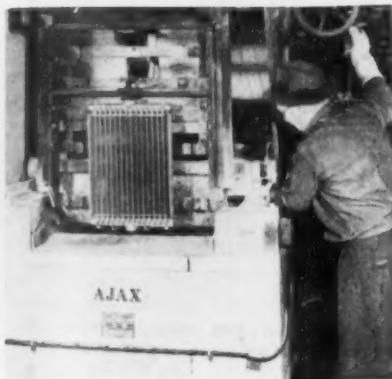
SOLUTION

Hardface the wearing surface of the guides with Coast Metals No. 119 and grind smooth.

RESULTS

Greatly extended service life and a sizeable reduction in the number of shutdowns required for replacement.

Data courtesy Coast Metals, Inc., Little Ferry, N. J.



JOB

Braze 44 copper tubes to a radiator manifold.

PROBLEM

To do the job in a single operation quickly.

SOLUTION

Immerse portion of assembly to be brazed in Ajax Electric salt bath furnace.

RESULTS

Tubes simultaneously brazed to manifold in less than 3 minutes. Brazed joints stronger than parent metal.

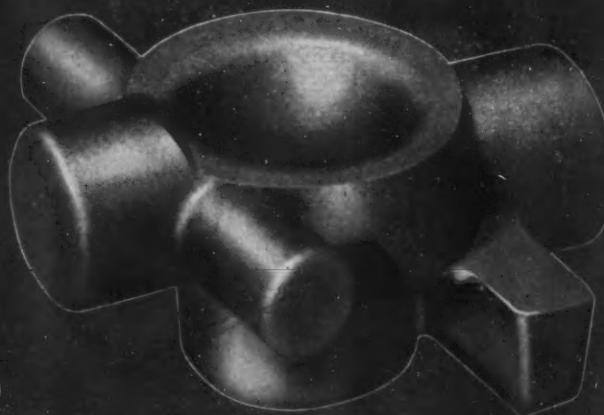
Data courtesy Ajax Electric Co., Inc., Philadelphia

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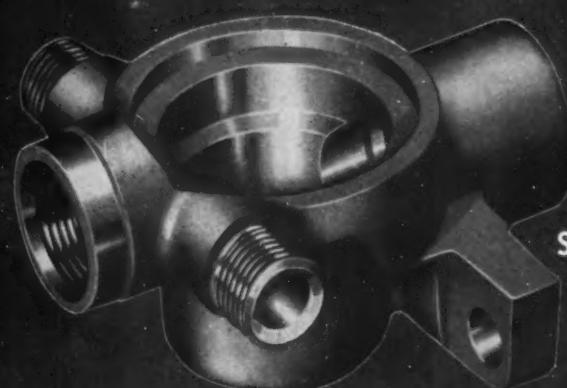
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Welding Notebook

JOB

Cast iron pile driver cylinder repair.

PROBLEM

To successfully weld several cast iron pile driver cylinders broken under severe service conditions. Welds had to be made in the field without preheat.

Data courtesy Ampco Metal, Inc., Milwaukee

SOLUTION

Cracked and broken parts welded with Ampco-Trode 10 electrodes and metal-arc process.

RESULTS

Joints were strong and sound and cylinders withstood rough service conditions without failure.



JOB

Welding cast iron shear support in warehouse of metal distributor.

PROBLEM

A metal distributor's cast iron shear support would take weeks to replace, cost several hundred dollars. Shear had to be ready to handle emergency orders for cut-to-size pieces of metal at any time.

SOLUTION

Support was welded together in about 3½ hours with 5 lb of Ni-Rod "55" welding electrode, without preheat or post-heat.

RESULTS

Cast iron shear was back in operation the following day.

Data courtesy The International Nickel Co., Inc., New York



JOB

Fabricate a gas meter component from two stampings and a screw machine part.

PROBLEM

To make a better part in less time, replace a casting and assure leak-tight construction.

SOLUTION

Parts are assembled in a positioning fixture and a half-ring of Easy-Flo 45 brazing alloy preplaced at the joint. Parts are brushed with Handy Flux and heated under gas-air burners.

RESULTS

One operator per shift, production averages 2600 per week. Parts are joined into one strong gas-tight piece, overcoming porosity and reducing manufacturing cost.

*Data courtesy Handy & Harman
New York*

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Without the Hazard of "Strong" Acids!

Before Pickling

After Pickling with Magnus D-Scale-RS

Muriatic and sulphuric acids are the time-honored materials for pickling . . . but they are relatively undependable wherever the consequences of attack on the metal are serious. They are hard to handle . . . hard to store safely. Above all, they are always corrosive fluids, ready to attack humans the instant there is contact with any part of the body.

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Magnus D-Scale-RS is a fast-acting acid on scale and rust. But it is inhibited against attack on the metal proper. It insures far better pickling action than mineral acids. It is fumeless in use . . . safe in handling and in storage. It can be used either in hot or cold solution . . . in tumbling barrels as well as in tanks.

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THE IRON AGE SUMMARY...

- **Steelmaking rate settles into year-end "groove"**
- **Buyers delay ordering, press for concessions**
- **Scrap prices reflect dimmer near term outlook**

Steelmaking operations have settled into a year-end "groove" below 90 pct of rated capacity, and there is little prospect of much improvement before February. Operations this week are scheduled at 86.0 pct of rated capacity, down 1 pct from last week.

Buyers are hesitant. Buying policy is restricted. Inventories continue to depress the market. And big consumers are delaying ordering needed tonnage as long as possible, while they try to hammer out additional price concessions.

Yet steel business is expected to be good through the first half of next year. Operations below 90 pct of capacity aren't hurting the bulk of the industry badly.

In the first place, bulk of the decline in steelmaking can be traced to electric furnaces. In October, last month for which statistics are completed, electric furnace ingot rate had sunk to 56.3 pct of capacity, while openhearth furnaces were still operating at 99.1 pct of capacity. Since then both rates have declined, but openhearts are still averaging over 90 pct.

Electric furnace decline can be traced to (1) end of demand for expensive conversion steel, (2) a generally weak market for alloy and stainless steels, and (3) stretch-out of military programs. All these developments were anticipated earlier in the year, and the decline in electric furnace operation was not unexpected.

One other factor should be pointed out: Even at 50 pct of capacity today, the industry is producing more electric furnace steel than it could turn out at 100 pct 6 years ago.

Another reason lower operations aren't hurting as badly as might be expected is that some companies are actually effecting economies. Some of them are less overtime pay, lower material cost (scrap for example), and more efficient scheduling of production.

Some companies are achieving additional operating economies by retiring marginal, high cost facilities. For example, U. S. Steel by the end of this year will have curtailed

operation of a total of 1.8 million tons of tired capacity in three plants in the Pittsburgh area. This is not a retrenchment in that area because the same company has added 3.7 million tons of new capacity there since World War II.

In each case retirement of the old capacity was anticipated and other facilities were expanded to more than offset the loss. Result will be an increase in overall operating efficiency within the Pittsburgh district, with less intracompany shipment of iron and steel.

But steel buyers are playing it close to the vest, deferring buying as long as possible while they try to parlay better deals on freight absorption or other steel cost concessions. This strengthens belief that January business might be about the same as December and the worst in the first quarter.

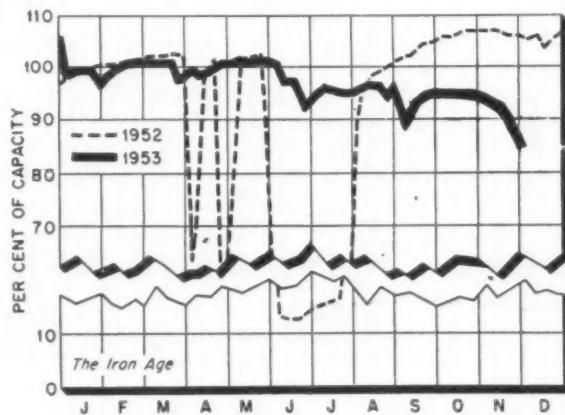
The scrap market reflected the dimmer outlook for near term steelmaking operations. THE IRON AGE Steel Scrap Composite Price sank \$1.83 a ton to \$32 per gross ton. Consumer stocks are still large.

Steel Operating Rates

	Week of Dec. 6	Week of Nov. 29		Week of Dec. 6	Week of Nov. 29
Pittsburgh	85.0	80.0*	Detroit	89.0	85.0*
Chicago	93.5	94.5	Birmingham	96.5	96.5
Philadelphia	91.0	91.0	Wheeling	86.0	83.0*
Valley	82.0	85.0*	S. Ohio River	78.0	81.0
West	87.5	88.0*	St. Louis	83.5	85.0
Cleveland	83.0	87.0	East	84.5	85.5*
Buffalo	99.5	99.5	AGGREGATE	86.0	87.0

Beginning Jan. 1, 1953, operations are based on annual capacity of 117,547,470 net tons.

* Revised





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You can make it BETTER with
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Markets at a Glance

Corporation Cuts Capacity . . . Steelmaking capacity of U. S. Steel Corp. in the Pittsburgh district will be further reduced Dec. 24 by shutdown of five remaining openhearts at the No. 1 shop of the Duquesne Works. Capacity of this shop was rated at 375,000 tons at start of this year. In addition, U. S. Steel plans to halt steelmaking in openhearth furnaces at its Vandergrift plant next fall. Capacity of these furnaces is 480,000 tons. Loss of the Duquesne shop will be largely offset by increases of 200,000 tons yearly capacity at the No. 2 shop and an additional 160,000 tons at an electric furnace shop.

J & L Changes Extras . . . Jones & Laughlin Steel Corp. has revised carbon steel plate extras. Changes include reductions in size extras and item quantity extras.

Canadian Steel Market Firm . . . Canadian steel producers say first quarter order books have been filled on practically all products. Heavy demand is anticipated through the first half of 1954. Competition from the U. S. and European steelmakers is expected to get stronger.

Gets Rail Order . . . Illinois Central R. R. Co. has placed an order for 6000 tons of 132-lb steel rails with Tennessee Coal & Iron Div., U. S. Steel. In the past few weeks, T C & I has received orders for a total of 51,000 tons of 132-lb rail.

French to Make Plastic Pipe . . . Societe Des Fonderies de Pont-a-Mousson, Nancy, France, will produce glass-fiber-reinforced plastic pipe under license from Reflin Co., Los Angeles.

Book More Civilian Steel . . . Some midwest steel salesmen say they are booking more civilian tonnage for January 1954 than they did for the same month this year. In evaluating steel purchases for the first quarter of next year, it must be remembered that none of it is conversion. This means that while total tonnage of orders placed may not be equal to the '53 quarter, in terms of finished steel purchases they may actually be larger.

Lowers Price . . . Detroit Tube and Steel Div., Sharon Steel Corp., has reduced its cold-rolled strip price to \$5.65 per ton and also dropped C-R spring steel (0.26 pct to 0.40 pct carbon) to the same level.

Cut Plate Prices . . . Lukens Steel Co. recently reduced the price of its carbon and alloy steel plates. New prices are \$4.20 per 100 lb for carbon plate and \$5.55 per 100 lb for alloy plate. Claymont Steel Corp., Colorado Fuel & Iron subsidiary, has also cut its carbon and alloy plate prices to the same levels.

Price Changes . . . Detroit Steel Corp. has reduced prices on cold-rolled steel strip (0.25 pct maximum carbon and under) to \$5.65 per 100 lb f.o.b. mill, Detroit, and \$5.90, f.o.b. mill, Hamden, Conn. In addition the company adjusted prices on cold-rolled spring steel. Changes were effective Dec. 1.

Open-End Nickel Stainless Exports . . . In the first quarter of 1954, exports of nickel-bearing stainless will be on an open-end basis. Time schedules for filing export license applications have also been abolished and may be filed at any time.

Help Small Business . . . Government is working on plans to provide a central office where small business can find out what General Services Administration is buying and what services are available from Small Business Administration. Business information services of the two agencies will soon be merged.

Shutdown Blast Furnace . . . Hanna Furnace Corp. closed down one of its four Buffalo blast furnaces for repairs last week, coincident with the end of the Great Lakes shipping season. The furnace which has a rated capacity of 200,000 tons will be out for an indefinite period.

Prices At A Glance

(cents per lb unless otherwise noted)

	This Week	Last Week	Month Ago	Year Ago
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Composite Prices				
Finished Steel, base	4.632	4.632	4.634	4.376
Pig Iron (gross ton)	\$56.59	\$56.59	\$56.59	\$55.26
Scrap, No. 1 hvy.				

(Gross ton)	\$32.00	\$33.83	\$35.33	\$42.00
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Nonferrous Metals

Aluminum, ingot	21.50	21.50	21.50	20.00
Copper, electrolytic	29.75	29.75	29.75	24.50
Lead, St. Louis	13.30	13.30	13.30	13.80
Magnesium, ingot	27.00	27.00	27.00	24.50
Nickel, electrolytic	63.08	63.08	63.08	59.58
Tin, Straits, N. Y.	84.75	82.25	81.75	\$1.21 1/2
Zinc, E. St. Louis	10.00	10.00	10.00	12.50

Chile Senate Okays Copper Proposals

Price for surplus approved at 30¢, going price for future production . . . But lower House still must approve and tax legislation is needed—By R. L. Hirschek.

One long stride has been taken in the direction of clearing up the Chilean copper confusion. The Chilean Senate last week approved recommendations of the committee on terms of sale. But don't look for the signing of a contract this week—there are still several points that require action. At presstime the lower House had yet to pass the proposal.

Outline Terms . . . Here's what the Senate agreed to: (1) Surplus will be sold at 30.00¢ per lb, (2) new production will be sold at the going world market price, (3) sales will not be made to Communist countries, (4) currency exchange rates and taxation of American mining companies will be revised, and (5) the producing companies will be permitted to market the copper.

Aside from lower House approval, certain legislation must yet be passed to permit the tax revision and negotiations with the U. S. must be resumed. And the uncertain wording of these terms must be cleared up: Is the 30¢ price delivered or f.o.b. Chilean port? How will the going world price be determined? What is the tonnage of the surplus?

Strike Over . . . On the last point, tonnage has been estimated

anywhere from 100,000 to 120,000 tons and at least 80,000 tons is already in the U. S. The strike at Anaconda Copper Mining Co. properties in Chile, which slowed the growth of the surplus is over.

The problems haven't been settled but workers agreed to return to their jobs for 30 days while negotiations are carried out. The stoppage lasted a month and a half, cost about 30,000 tons in lost copper production.

Marketwise, all this news from Chile hasn't caused much of a ripple in the U. S. Main reason was that this action was pretty well anticipated. Impact won't be felt until the deal's closed and the Chilean copper starts to hit the market. Men in the industry freely predict prices will start skidding at that point.

Aluminum for Building . . . When the final tallies are in, aluminum use for building products will total some 280,000 tons in 1953, according to Edward C. Manix, general sales manager of Nichols Wire & Aluminum Co. This represents a 33 pct gain over 1952's total of 202,000 tons.

It's interesting to note that for both 1952 and 1953 consumption of the aluminum building products industry comes out very close

to 22 pct of primary ingot production. Mr. Manix is optimistic, estimating use for this purpose will total 375,000 tons during the next year.

He cited aluminum chain-link fence for the biggest percentage increase in 1953, more than doubling in sales, and window frames as an example of aluminum's conquest of other materials. In 1949, Mr. Manix stated, 5 pct of all window frames, wood or metal, were aluminum. In 1953 aluminum frames were 20 pct of total.

Keep Mines Busy . . . The U. S. is not a "have not" which must preserve natural resources by keeping them in the ground. That was the view expressed by Andrew Fletcher, president of St. Joseph Lead Co. at the Mid-Century Conference on Resources for the Future held in Washington last week.

Continuing mine shutdowns, he warned, are making the U. S. more dependent on foreign sources which he termed "not reliable." Mr. Fletcher blamed wide price fluctuations in lead and zinc on "alternate withholding and flooding" of the U. S. market by imports.

He called for an anti-dumping tax which would vary according to price levels. This would give protection to the domestic mining industry when needed, keeping it prosperous and going—"the best and cheapest stockpile," Mr. Fletcher said.

Still Coasting . . . With the exception of some life in the export market for lead, almost nothing is happening in lead and zinc trading. Buyers are seeking only what they need for the immediate future—with supplies so far in excess of consumption, they see no need to carry large inventories.

Declining imports and smelter cutbacks are paring supplies closer to the demand level but smelter stocks of slab are too big for any immediate price shifts.

NONFERROUS METAL PRICES

(Cents per lb except as noted)

	Dec. 2	Dec. 3	Dec. 4	Dec. 5	Dec. 7	Dec. 8
Copper, electro, Conn.	29.50— 30.00	29.50— 30.00	29.50— 30.00	29.50— 30.00	29.50— 30.00	29.50— 30.00
Copper, Lake delivered	30.125	30.125	30.125	30.125	30.125	30.125
Tin, Straits, New York	81.75	82.75	83.25	—	84.75	84.75*
Zinc, East St. Louis	10.00	10.00	10.00	10.00	10.00	10.00
Lead, St. Louis	13.30	13.30	13.30	13.30	13.30	13.30

Note: Quotations are going prices

*Tentative



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Come hell or high water, there are some people who simply won't be denied the privilege of doing their duty. It's just a matter of basic character, disciplined by daily diligence . . . and, as much as anything else, a pride in maintaining a record that has been so painstakingly built.

This is the kind of duty that Bristol Brass men understand so well. They, too, have a name for "always being on the job" . . . and they won't stand for the smallest nick in that name . . . if determination, brains and resourcefulness

can help it. *And they have plenty of all three.* Try Bristol Brass service on your own sheet, rod and wire needs. You may encounter *two* new experiences . . . in quality, as well as in service.

The BRISTOL BRASS CORPORATION, makers of Brass since 1850 in Bristol, Conn. Offices or warehouses in Boston, Chicago, Cleveland, Dayton, Detroit, Los Angeles, Milwaukee, New York, Philadelphia, Pittsburgh, Providence, Rochester.

"*Bristol-Fashion*" means **Brass at its Best**

Iron and Steel Scrap Markets

Prices Nosedive In Sales Slump

**Steelmaking scrap movement virtually nil in most districts
... Little improvement expected until Jan. orders start . . .
High ore stocks portend more hot metal use.**

Faced with that most devastating of all market weapons, consumer disinterest, scrap prices nosedived throughout the country this week. Prices had already reached alluring lows, but mills apparently just weren't having any. Traditional year-end steelmaking decline on top of already lower operations merely deepened scrap seller's gloom. To further blacken their outlook, end of the Great Lakes shipping season found ore stockpiles at record highs, portending boosted use of hot metal throughout the winter.

With No. 1 heavy melting prices off anywhere from \$1 to \$3, THE IRON AGE Steel Scrap Composite fell \$1.83 from last week's \$33.83 to \$32.00. Price softness in virtually all areas covered both steelmaking and blast furnace grades. Electric furnace and railroad items were also hit, with one major road taking its rail scrap off the market because it felt prices offered were too low. Cast, with a few exceptions, was not too badly hit, although previous prices had not been high.

Pittsburgh—Outlook for balance of the year is poor. Consumers are expected to coast along on present inventories in the face of declining ingot rates. Last purchase by an independent mill pegged No. 1 steel at \$34, off \$3 per ton. Secondary openhearth grades were down \$2. Entire list was off \$1 to \$3 on appraisal. U. S. Steel's pending shutdown of five openhearth furnaces at Duquesne Works and eventual scrapping of these and 15 others previously discontinued compounded trade pessimism.

Chicago—After waiting hopefully, Chicago scrap began skidding last week when mill sales failed to peg the market. With lessened mill activity expected for remainder of the year, outlook was for a further drop. Scrap inventories at the dealer level

are reported fairly low, despite a long lull in turnings activity and small volume buying in steelmaking grades. Those who still have scrap in any quantity appear willing to let it go in the expectation that scrap may drop further before the year's end. Rail prices began finally to slide last week. Turnings appear harder hit than most scrap items, and activity was extremely low in this grade despite some very attractive offering prices.

Philadelphia—Practically no business was transacted in openhearth grades during the past week, but one sale served to peg the market lower. While no business at all was reported in electric furnace scrap, the general attitude was extremely easy and prices are quoted lower on appraisal.

New York—Almost total lack of consumer interest has brought broker buying of steelmaking and blast furnace grades to a virtual standstill in this district. Prices are off \$2 to \$3 per ton on basis of a small sale last week and further declines in neighboring consuming districts this week. Cast movement continues, with prices unchanged.

Detroit—A slow December seems to be in the cards for the scrap trade here. There is no local movement of scrap and very little going out of the district. Optimists hope that before the month ends larger consumers who have been out of the market for months will have to make some purchases and put a floor under prices.

Cleveland—Scrap prices dropped another \$1 across the board here as the market continued its year-end tailspin. Further weakness is expected since one consumer in the Cleveland area reportedly will hold up shipments entirely within the next 2 weeks. One major carrier took its railroad scrap off the auction block because bidding was considered too low.

Birmingham—Largest buyer in the district was back in the market this week for openhearth and black furnace scrap at a reduction of \$2. A Georgia mill that has been holding up deliveries released them this week. Birmingham foundries that have been offering a \$2 premium for No. 1 cast and stove plate from points west of the Mississippi River and north of the Ohio River have withdrawn their premium offers.

St. Louis—An East Side mill came into the market during the week for No. 1 and 2 heavy melting and No. 1 and 2 bundles at from \$3 to \$4 a ton below preceding quotations, but other mills are not buying because of the usual holiday lull. Other items, especially premium grades, are off \$1 to \$4 a ton as brokers reduce prices in anticipation of a lower market when mills resume buying later this month for January shipment. Some distress scrap was being offered.

Cincinnati—Random length rails and 18-in. crops slipped \$1 to \$39 and \$47 respectively on the basis of limited buying. Otherwise flow of scrap was at a standstill. Brokers say new business is impossible to find at any price.

Buffalo—Gloom settled over a quiet scrap market as dropping off of buying forced prices down \$2 a ton. Leading mills either were out of the market or held up shipments. Top buyer notified dealers that it would not enter market during the current month. Embargo on shipments was extended to cast by the principal user.

Boston—Market here is just about dead with the exception of some No. 1 heavy melting and electric furnace material moving locally, mostly to Worcester. This has brought about the wide spread in price quotations on these items. Blast furnace scrap plunged from \$2 to \$5 per ton.

West Coast—Loading of first scrap for Japan since export curb easing was interrupted at Oakland, Calif., by waterfront labor strife last week. Shipment was 8000 tons steel scrap plus 1 ton copper scrap, with shipping costs after loading estimated at \$8.50 per ton in a Greek bottom. In Seattle prices for No. 1 and No. 2 heavy melting were off \$2 to \$27 and \$25 respectively with tonnage reduced.

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Ultimate tensile strength lbs. per sq. in.						
Sand Cast.....	125,000	115,000	108,000	100,000	90,000	85,000
Rolled 1 ² and under.....		120,000	110,000	105,000	95,000	85,000
Rolled or Forged, over 1 ²		115,000	108,000	100,000	90,000	85,000
Yield Point (divide method)						
Sand Cast.....	95,000	75,000	60,000	55,000	45,000	40,000
Rolled 1 ² and under.....		75,000	65,000	60,000	50,000	45,000
Rolled or Forged, over 1 ²		75,000	65,000	60,000	50,000	45,000
Elongation in 2 ¹ -%						
Sand Cast.....	10	12	14	15	20	25
Forged or Rolled.....		12	13		15	20
Reduction in area-%						
Sand Cast.....		12	14	15	20	25
Forged or Rolled.....		12	13		15	20
COMPRESSION						
Yield Point—						
lbs. per sq. in.	70,000	65,000	58,000	50,000	40,000	35,000
Permanent Set at						
100,000 lbs. per sq. in. (max.)	.015	.020	.030	.050	.080	.125
Brinell hardness, No.	250	240	220	200	175	150

List of U. S. Government Specifications Covering HY-TEN-SL Bronze

ARMY	WATERTOWN and OTHER ARMY ARSENALS
Forgings, Rolled Rod QQ-B-721 Class B	
Castings...QQ-B-726 Class B and C	
NAVY	WATERSIDE and OTHER NAVY ARSENALS
Forgings and Rolled Rod 46B15d Class B	
Castings, Aluminum-manganese	
Bronze	46B29 See Navy and Army (above).

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42" x 96" centers NILES Timesaver Heavy Duty Lathe, 42" swing over ways, rapid traverse, anti-friction head, AC-MD
40" x 20" NILES BEMENT POND Geared Head Engine Lathe, rapid traverse
No. 1A WARNER & SWASEY Universal Turret Lathe, Timken spindle, electric chuck
No. 3A WARNER & SWASEY Turret Lathe, Timken spindle, electric chuck, tooling
3 1/2" bar LUCAS Table Type Horizontal Boring Mill, vertical milling attachment, power rapid traverse, AC-MD
No. 2CH KEARNEY & TRECKER Vertical Mill, 1951
No. 2H KEARNEY & TRECKER Horizontal Milling Machine, new 1945
No. 2 VAN NORMAN Plain Horizontal, new 1943
No. 3-24 CINCINNATI Plain Hydromatic Mill, AC-MD
No. 4 CINCINNATI High Speed Dial Type Plain Horizontal Mill, new 1943
No. 4 CINCINNATI Dual Power Vertical Mill, 1951
No. 4H KEARNEY & TRECKER Vertical Mill, new 1944
25A HEALD Rotary Surface Grinder, 24" diameter magnetic chuck, AC-MD
No. 6G SELLERS Drill Grinder, AC motor, late type
1 1/2" LANDIS Bolt Threader, leadscrews, AC-MD
75 Ton Henry & Wright Double Crank Dieing Machine, roll feed & scrap cutter.
600 Ton CHAMBERSBURG Wheel Press, cast steel frame, inclined, AC-MD
30" MORTON, Hydraulic Keyseater, new 1942
48" x 48" x 12' NILES Double Housing Planer, 2 rail heads, 1 side head, power rapid traverse
3 1/2" column AMERICAN Radial Drill, box table, 1943
48" widened to 69" x 12' DETRICK & HARVEY Double Housing Planer, box table, DC reversing motor drive
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NEWS OF USED AND REBUILT MACHINERY

Dip 25 Pct . . . Dealers in used and rebuilt machinery in Detroit are starting to total up 1953 receipts for comparison with 1952 and prospects for 1954.

Feeling is that business will be off at least 25 pct from last year. Opinion is about evenly divided on whether the 1954 trend will continue downward or level off at the current rate.

The trade is traditionally pessimistic and anyone listening to dealer troubles over the past 18 months might have expected a 50 pct casualty rate. But the fact is that few if any established dealers have had financial troubles. Those who faded from the scene were classed as "operators" and only appeared along with the fat pickings of Korean boom.

Price Main Factor . . . The undeniable fact that business is down from a year ago doesn't mean that there is a period of famine at present. Most dealers admit there is a market that can be tapped by pricing and sales effort.

Probably the best business opportunity for used machinery in the Detroit area is among shops which might be interested in modernizing. Because of the shortage of good quality, late model machinery in the past few years, many of these shops have been struggling along on antiquated equipment and would like to bring their operations up to date.

This isn't always easy, however, because not all the equipment they need is in good supply. They also want a good trade-in allowance on their old machinery. Nevertheless, around 90 pct of all small to medium-size shops in the area do need to modernize their equipment.

Wait for a New One . . . In a few cases contacted by THE IRON AGE, price has been a major deterring factor as far as small shops are concerned. In some

cases good equipment isn't available at any price. But even if a scarce piece of machinery can be obtained, the shop owner hesitates to pay new prices for used machinery. His reaction: He'll wait for a new one.

It's been said before, but dealers are now beginning to realize that times are changing. They had been selling delivery. Now they have to sell price.

Some tool dealers have mentioned a new problem, the potential customer who wants to trade in a foreign-made machine tool. While many dealers did accept lines of new foreign equipment when they couldn't get anything else, they are now reluctant to deal in used imported machinery. They don't like to service unfamiliar equipment and don't like to guarantee it.

Want Presses . . . In the Detroit market the items in top demand at the moment are Kellers or duplicating equipment of any kind. Large presses could be sold easily if there were any on hand. Small manufacturers object to the price of new presses and would prefer to buy used presses if possible.

Demand for toolroom equipment is still good. Hard-to-find items continue to be radial drills, jig borers, jig grinders, light mills, surface grinders.

NISA Contest . . . National Industrial Service Assn. is holding its 10th prize award contest for shop ideas, tools or gadgets of benefit to the electric motor repair industry. Entries may be submitted by photograph, sketch, written description, or blueprint and should be addressed to Executive Secretary, National Industrial Service Assn., 818 Olive St., St. Louis 1, Mo.

The contest is open to anyone, and entries must be submitted by Mar. 15, 1954. Top award is \$350 and in addition 13 other prizes will be given.